CANADIAN ROCKY MOUNTAINS ECOREGION

PHYSIOGRAPHY AND FISH AND WILDLIFE DIVERSITY

Geography

The Canadian Rocky Mountains ecoregion includes about four percent of Washington in the far northeastern corner of the state. The rest of the ecoregion extends through adjacent British Columbia and Idaho and continues into Alberta and Montana. This ecoregion contains some of the most diverse wildlands remaining south of Canada, providing sanctuary for a host of threatened or endangered species.

The Selkirk Mountains and the north-flowing Pend Oreille River are the two dominant features of this ecoregion in Washington. The Selkirks are transitional between the rolling Okanogan highlands to the west and the higher Rocky Mountain ridges and mountains interlaced with wide valleys to the east.

Geology

Historically, the Washington portion of the ecoregion was almost completely glaciated, and now displays ice-carved, U-shaped moraine valleys and isolated, ice-sculpted mountain peaks. Elevations range from 1,300 feet along the Columbia River to greater than 7,000 feet in the Salmo-Priest Wilderness area.

Climate

Climate in the ecoregion is varied. The northern portion is characterized by cool, boreal weather, with rainfall around 80 inches in the Salmo-Priest Wilderness Area. The rest of the ecoregion experiences more moderate climate conditions; maritime weather patterns extend inland from the Pacific Ocean and influence the climate in all but the easternmost part of the ecoregion in Washington. Although annual precipitation is less than 18 inches along the Columbia River south of Northport, Washington, most of the ecoregion lies within a 24- to 34-inch precipitation zone. Significant snowpack develops in mid- and upper elevations of the Selkirks.

Habitat and Plant Associations

Coniferous forests dominate this ecoregion, although forest composition reflects variations in moisture, temperature and elevation. Douglas-fir/ponderosa pine forests tend to occur at lower elevations, while grand fir/western hemlock/western redcedar forests are characteristic of mid-montane elevations. Subalpine fir/Engelmann spruce forests are usually found at higher elevations along with parklands of whitebark pine, lodgepole pine and subalpine larch. Valley rivers and streams are often lined with riparian stands of willows and cottonwoods. Native grasslands occur along the foothills and on higher elevation, south-facing slopes. These grasslands are variously dominated by green fescue, Idaho fescue or rough fescue. Fire has played a significant role in the development and evolution of the forests in this ecoregion.

Fish and Wildlife Diversity

The rugged wilderness and varied topography of the Canadian Rocky Mountains ecoregion harbor a variety of wildlife, and some of the most rare and imperiled species in Washington, including woodland caribou, grizzly bear, gray wolf, wolverine, fisher and lynx. The region is also known for its healthy populations of large game species such as bighorn sheep, mule deer, white-tail deer, black bear, Rocky Mountain elk and moose. The ecoregion's extensive watershed systems support significant freshwater biodiversity, including burbot, white sturgeon, rainbow trout, dolly varden, bull trout, mountain whitefish, mottled sculpin, cutthroat trout and, formerly, anadromous salmon.

LAND OWNERSHIP

Most of the Washington portion of the ecoregion is public land managed by federal and state agencies such as the USDA Forest Service, U.S. Fish and Wildlife Service, and the Washington Department of Natural Resources. Aside from a few mining claims in the mountains, most private lands are located in the valley bottoms, which also include the best soils and access to water.

In Washington, there is an extensive system of smaller public and private reserves throughout the ecoregion. Of these reserves, about 3 percent are protected from commercial logging, and 21% have moderate protection.

The Washington section of the ecoregion has experienced relatively rapid population growth and changes in land use over the last 50 years. Traditional industries and occupations such as forestry and mining are still important, but tourism, including skiing, hiking, hunting, fishing and water sports, has shown substantial growth, resulting in increased commercial/recreational developments and associated vacation home/retirement communities. Since the 1970s, the development of hydroelectric power projects such as Boundary Dam on the Washington-British Columbia border has also had a major impact on both the regional economy and the landscape. Figure 30 maps land ownership classes in the Canadian Rocky Mountains ecoregion.

Figure 30.

Canadian Rockies Ecoregion
Land Ownership
USFS
NPS
Other Federal
WDFW
WDNR
Other State/County/City
Indian Reservation
Private

ECOREGIONAL CONSERVATION PARTNERSHIPS

Effective conservation of fish, wildlife and biodiversity in Washington requires close coordination and cooperation with many public and private conservation partners. Major partners in the Canadian Rockies ecoregion include:

- Pend Oreille, Stevens and Spokane Counties
- U.S. Bureau of Land Management
- U.S. Fish and Wildlife Service (Little Pend Oreille National Wildlife Refuge)
- U.S. Forest Service (Colville National Forest, Washington portion of Idaho Panhandle National Forest)
- Washington Department of Natural Resources (WDNR)
- Washington State Parks and Recreation Commission

The Washington Department of Fish and Wildlife also works closely on conservation projects with private conservation partners such as The Nature Conservancy, Trust for Public Land, Rocky Mountain Elk Foundation, Audubon Washington, Ducks Unlimited and a growing number of fisheries enhancement groups and local land trusts.

Major Plans and Assessments

A number of ongoing or completed planning efforts involving WDFW and its public and private partners guide the conservation and management of fish and wildlife resources statewide and in the Canadian Rockies ecoregion. Important planning efforts affecting conservation in the Canadian Rockies ecoregion include:

- Canadian Rockies Ecoregional Assessment
- Pend Oreille, Spokane, and Columbia Upper Subbasin Plans (2004)
- Selkirk Mountains Woodland Caribou Herd Augmentation in Washington Cooperative Interagency Plan (1996)
- USFWS Draft Bull Trout Columbia River DPS Recovery Plan (2002)
- USFWS Grizzly Bear Recovery Plan (1993)
- USFWS Northern Rocky Mountain Wolf Recovery Plan (1991)
- USFWS Selkirk Mountains Woodland Caribou Recovery Plan (1994)
- Washington Forest Practices Board Wildlife Strategy (in progress)
- Washington Forests and Fish Agreement (1999)
- WDFW Bald Eagle Status Report (2001)
- WDFW Bull Trout and Dolly Varden Management Plan (2000)
- WDFW Common Loon Status Report (2000)
- WDFW Fisher Recovery Plan (2005)
- WDFW Fisher Status Report (1998)
- WDFW Game Management Plan (2003)
- WDFW Le Clerc Wildlife Area Plan (2006)
- WDFW Lynx Recovery Plan (2001)
- WDFW Northern Leopard Frog Status Report (1999)
- WDFW Outline for Salmon Recovery Plans (2003)
- WDFW Peregrine Falcon Status Report (2002)
- WDFW Pygmy Whitefish Status Report (1998)

Supporting references to these and other important statewide planning documents are included at the end of this chapter and/or in Appendices 6 and 7.

SPECIES AND HABITATS OF GREATEST CONSERVATION NEED

This section provides a short summary of priority species and associated habitats for the Washington portion of the Canadian Rockies ecoregion.

Species of Greatest Conservation Need

The following species list for the Canadian Rockies ecoregion is a regional subset of the statewide Species of Greatest Conservation Need (SGCN) list shown in Appendices 1 and 2. The process and criteria used to develop the statewide SGCN list are provided in Volume Two: Approach and Methods, as well as in Appendix 3. Species listed below are found in the Canadian Rocky Mountains ecoregion for all or part of their lifecycle. Supporting tables and information for these species and habitats can be found in Chapter IV and in Appendices 1, 2, 8, 9, 10 and 14.

	Population Size/Status						Population Trend					
COMMON NAME	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown	State Status*	WNHP
Mammals												
Townsend's big-eared bat			x							x	C	S3
Gray wolf	?									x	E	S1
Grizzly bear		x							x		E	S1
Fisher	x							x			E	SH
Wolverine		x						x			C	S1
American badger			x				x				G	S4
Lynx			x							x	T	S1
Woodland caribou		x					x				E	S1
Birds												
Common loon			x					x			S	S2
Great blue heron			x							x	M	S4
Northern pintail					x		x				G	S3
Redhead			x					x			G	S3
Lesser scaup				x			x				G	S4
Bald eagle				x					x		T	S4
Northern goshawk			x							x	C	S3
Golden eagle			x							x	C	S3
Peregrine falcon			x						x		S	S2
Flammulated owl			x							x	C	S3
Vaux's swift			x				x				C	S3
Lewis' woodpecker			x				x				C	S3

COMMON NAME	Population Size/Status						Population Trend				State Status*	WNHP
	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown		
Black-backed woodpecker			x							x	C	S3
Pileated woodpecker				x						x	C	S4
Pygmy nuthatch			x							x	N	S3
Amphibians												
Western toad				x			x				C	S3
Northern leopard frog			x				x				E	S1
Columbia spotted frog			x							x	C	S4
Fish												
Westslope cutthroat				x				x			G	G4
Inland redband trout						x				x	G	G5
Bull trout						x				x	C	G3
Pygmy whitefish						x				x	S	S1
Invertebrates												
Silver-bordered fritillary (butterfly)			x							x	C	S3

* Status Codes	** WNHP Codes (S = state, G = global)
E = endangered	1 = critically imperiled
T = threatened	2 = imperiled
S = sensitive	3 = vulnerable to extirpation or extinction
C = candidate	4 = apparently secure
M = monitor	5 = demonstrably widespread, abundant and secure

Species Conservation in the Canadian Rockies Ecoregion

Species of Greatest Conservation Need (SGCN) found in the Canadian Rockies ecoregion (see table above) include those classified by WDFW as Endangered, Threatened, Candidate or Monitor species, as well as species identified by WDFW as needing additional research or funding attention. A range of conservation actions is recommended for these SGCN species at both the statewide and ecoregional levels. These recommended conservation actions are summarized in a series of matrices included in Chapter IV and as Appendices 9 and 10. These matrices also display the life history, population status and distribution of these species.

Ecoregional Habitat Overview

In addition to expansive conifer forests, the Canadian Rockies ecoregion contains several other vegetation communities. Mountain meadows, riparian woodlands, upper treeline/alpine communities and scattered foothill grasslands exist throughout the ecoregion. The ecoregion is characterized by dramatic vertical zonation of vegetation and associated wildlife species. This zonation is a consequence of abrupt elevational gradients between flatlands and mountains. Secondary climatic effects of topographic relief (e.g. rain shadow effects, exposure to or shelter from prevailing winds and thermal inversions) likewise influence zonation. Figure 31 maps wildlife habitat classes for the Canadian Rocky Mountains ecoregion.

The following major habitat types classified, coded and described in Wildlife and Habitat Relationships in Oregon and Washington (WHROW), are present in the Canadian Rockies ecoregion. In the next section, descriptions are provided for priority habitats associated with Species of Greatest Conservation Need found in this ecoregion.

- Montane Mixed Conifer Forest
- Eastside (Interior) Mixed Conifer Forest
- Lodgepole Pine Forest and Woodlands
- Ponderosa Pine Forest and Woodlands
- Upland Aspen Forest
- Subalpine Parkland
- Eastside (Interior) Grasslands
- Agriculture, Pasture and Mixed Environs
- Urban and Mixed Environs
- Open Water: Lakes, Rivers and Streams
- Herbaceous Wetlands
- Montane Coniferous Wetlands
- Eastside (Interior) Riparian-Wetlands

Figure 31.

Canadian Rockies Ecoregion
Wildlife Habitat Classes
Westside Lowland Conifer-Hardwood
Westside Oak/Dry Douglas-Fir
Montane Mixed Conifer
Eastside Mixed Conifer
Lodgepole/Ponderosa Pine/Eastside Oak
Subalpine/Alpine Environs
Grasslands/Shrublands
Agriculture
Urban
Lakes/Rivers/Reservoirs
Wetlands
Coastal Land Environs
Bays/Estuaries

Priority Habitats in the Canadian Rockies Ecoregion

The following three habitat types have been identified as the highest priority for current conservation action in the Washington portion of the Canadian Rockies ecoregion. Selection of these habitats as a priority was determined by their importance to regional Species of Greatest Conservation Need, as well as priorities outlined in the Canadian Rockies Ecoregional Assessment and the subbasin plans listed in the "Major Plans" section above. More discussion on the selection of priority habitats is included in Chapter III: Statewide Overview and in Volume Two: Approach and Methods.

- Upland Forests and Woodlands
- Herbaceous and Montane Coniferous Wetlands
- Eastside (Interior) Riparian-Wetlands

Upland Forests and Woodlands

Upland mixed conifer forests contain a wide array of tree species and stand dominance patterns. Douglas-fir is the most common tree species. Lower elevations or drier sites have ponderosa pine and often have other shade-tolerant tree species growing in the undergrowth. On moist sites, grand fir, western redcedar and/or western hemlock are dominant. Other conifers include western white pine on mesic sites and subalpine fir on colder sites, as well as lodgepole pine, and ponderosa pine. Undergrowth vegetation varies from open to nearly closed shrub thickets with one to many layers. Herbaceous broadleaf plants are important indicators of site productivity and disturbance.

Timber harvest has been a primary land use in the ecoregion for over a century, resulting in the elimination of most mature and old growth stands and their replacement with stands of younger age and less complex structure. With timber management and increased population of the area, fire suppression became a standard practice. Effects of fire suppression include changes in successional stages and species composition of the forest stands. In general, early successional-stage forests of western larch, lodgepole pine, ponderosa pine and western white pine have decreased, while shade-tolerant species such as Douglas-fir and grand fir have increased.

Selected Species Closely Associated with Upland Forests and Woodlands in the Canadian Rockies Ecoregion

Gray wolf	Lynx
Grizzly bear	Fisher
Lewis' woodpecker	Wolverine
Pileated woodpecker	Woodland caribou
Black-backed woodpecker	Northern goshawk

Herbaceous Wetlands and Montane Coniferous Wetlands

Herbaceous wetlands are widely distributed across the ecoregion and are often associated with rivers, lakes and streams. Seasonally to semi-permanently flooded wetlands are found where standing freshwater is present through part of the growing season and the soil stays saturated throughout the season. Herbaceous wetlands are found in all terrestrial habitats in the ecoregion except subalpine parkland and alpine grasslands, and commonly form a mosaic with Eastside riparian-wetlands and montane coniferous wetland habitats along stream corridors.

Montane coniferous wetlands are forest wetlands or floodplains with a persistent winter snow pack, ranging from moderately to very deep. Flooding regimes include saturated, seasonally flooded and temporarily flooded. Seeps and springs are common. This habitat occurs along stream courses or as small patches within a matrix of montane mixed conifer forest or adjacent to other wetland habitats.

Selected Species Closely Associated with Herbaceous and Montane Coniferous Wetlands in the Canadian Rockies Ecoregion

Western toad
Vaux's swift
Silver-bordered fritillary butterfly

Eastside (Interior) Riparian-Wetlands

Mountain alder/willow riparian shrublands are major habitats in the forested zones of Washington's portion of this ecoregion. Eastside lowland willow and other riparian shrublands are the major riparian types at lower elevations. Black cottonwood riparian habitats occur throughout the ecoregion at low to middle elevations. Quaking aspen wetlands and riparian habitats are widespread, but rarely a major component. Ponderosa pine/Douglas-fir riparian habitat occurs only in the lower montane forests.

Riparian habitats occur along perennial and intermittent rivers, streams, wetlands and along lakes and ponds. Black cottonwood and willow riparian habitats occupy warm montane and adjacent valley and plain riparian environments. Riparian forests also appear on sites subject to temporary flooding during spring runoff. Irrigation of streamsides and toeslopes provides more water than precipitation and has become important in the development of this habitat in the ecoregion. Scrub-shrub and forested wetlands, seasonally flooded fields, persistently flooded emergent wetlands, shallow riverine sloughs, and ponds are present within and adjacent to floodplains.

Selected Species Closely Associated with Eastside (Interior) Riparian-Wetlands in the Canadian Rockies Ecoregion

Columbia spotted frog
Northern leopard frog
Great blue heron
Bald eagle

CONSERVATION PROBLEMS

A number of human activities pose potential threats to the integrity of wildlife habitat. These activities include incompatible forest and grazing practices, conversion of habitat to agriculture, dispersed residential development, pollution, overfishing and overhunting, water extraction, incompatible mining, hydropower and energy developments and transportation systems. These developments may disturb and displace wildlife, disrupt migration corridors, and encourage the establishment of invasive plant and animal species.

Forest Practices

Logging on both public and private land had a major impact on fish and wildlife habitat in the past and some forest practices have contributed to a decline in forest health through changed forest composition and the introduction of damaging diseases, insects and vegetation. While some harvest prescriptions are ecologically beneficial, in other instances the inappropriate use of downed wood harvests, even-age management and single-species selective harvests have contributed to the reduction of forest diversity throughout the ecoregion. Small areas of the ecoregion in Washington still exhibit intact forests of native tree species, but historical and current logging practices have eliminated most old growth forests, particularly of ponderosa pine, Douglas-fir and mixed coniferous forests.

Fire Suppression

In the fire-adapted ecosystems of the Canadian Rockies, fire is the dominant process in terrestrial systems, influencing vegetation patterns, habitats and ultimately, species composition. Fire management practices interact with several other threats to wildlife conservation areas; for example, altered natural fire regimes can lead to invasion by non-native fire-adapted plants or forests that are more prone to insect and disease impacts. Fire suppression in the interior Northwest region has profound ecological implications, including alteration of water, nitrogen and carbon cycles. Fire suppression has also resulted in overcrowded forests, which are less diverse, less vigorous and more susceptible to insect outbreaks, large forest fires and disease.

Invasive Alien Plant and Animal Species

Invasive plant and animal species are a significant threat to biodiversity, second only to habitat loss. They are introduced in a number of ways, including hitchhiking on horses, boats, cars and trucks. Invasive plants displace native vegetation, resulting in the loss of habitat diversity and function. They can severely impact native forest and animal communities, and alien grasses and shrubs can add significantly to the fire fuel load, resulting in hotter wildfires that increase damage to native vegetation. The number and abundance of introduced species in an ecoregion is an indicator of declining ecosystem health.

Residential Development

Residential development and expansion of dispersed residential areas into natural landscapes are among the most significant long-term threats to conservation targets in the Canadian Rockies ecoregion. Many conservation lands are owned and managed by the Forest Service and other public agencies, but a significant portion of low-elevation valleys and woodlands, riparian areas and montane grasslands are in private ownership and available for residential development.

Wetlands and riparian areas may be impacted from logging, agriculture and residential development that affect shorelines, water quality, water quantity and overall habitat continuity and complexity. This leads to increased erosion, which in turn increases sedimentation. Improperly managed livestock grazing compacts soil, contributes to stream bank destabilization, affects compositions of riparian plant communities, and slows recovery of damaged riparian habitat. This loss of riparian vegetation results in greater summer heating and winter cooling of stream temperature, soil instability, reductions in water quantity and quality, and changes in bank, channel and instream structure. All of these habitat changes affect the distribution and abundance of aquatic wildlife species.

Recreational Development

As the population of Spokane and northeast Washington grows, so does the demand for outdoor recreation, both natural and developed. Conversion of forest and woodland habitat for golf courses, ski areas (both new and expanded), and other development will continue as the population and demand grows. The tourism sector, including skiing, hiking, hunting, fishing, water sports, off-road vehicle use, snowmobiling, and biking, has shown the most substantial growth, resulting in increased commercial/recreational developments and associated home/retirement communities.

Transportation Systems

Transportation systems impact animals in several ways: roadkill, habitat loss and fragmentation and hindrance or barrier to movement and migration. When populations are low, roadkill mortality is significant, especially for slow-moving turtles and salamanders and wide-ranging carnivores that have to cross many roads. In a fragmented landscape animals have to move from one patch of habitat to another. When highways fragment landscapes, they divide wildlife populations into smaller, isolated units that are more susceptible to extirpation. Historically, construction of logging roads near streams or across wetlands was often extremely destructive to fish and wildlife habitat. Although modern forest practices under state and federal rules and regulations are much more likely to provide some protection for wetlands, there are still potential adverse impacts from construction and operation of logging roads. This occurs even when they are located along benches and ridgelines away from riparian zones. Improperly located, constructed or maintained logging roads may trigger or accelerate slope failure, erode stream channels, block fish migration and deposit sediment into streams and wetlands.

Rock and Gravel Mining

Rock mining and gravel mining historically and currently occur throughout the Canadian Rockies ecoregion. There are numerous active or abandoned mines in the region, many of which have degraded downstream aquatic and riparian ecosystems. Gravel mining destroys riparian vegetation and alters hydrology. While mining activities are a direct threat to aquatic targets, the habitat fragmentation and weed invasion that occurs along access roads impact many large-scale ecological systems. Bank sloughing has also reduced the extent of riparian vegetation along some river reaches.

The following additional habitat and species conservation problems have been identified in the Canadian Rocky Mountains ecoregion:

Wildlife species and population problems: includes disease, pathogens, competition, food scarcity, predation, overharvest, limited population size and distribution.

- Populations of grizzly bear, gray wolf, fisher, lynx, woodland caribou, common loon, bald eagle, peregrine falcon, northern leopard frog and pygmy whitefish have declined to the point that they are listed as endangered, threatened or state sensitive.
- Small population sizes and loss of genetic diversity are problems for grizzly bear, wolverine, lynx and woodland caribou, and are a concern for other species reduced to isolated populations such as the northern leopard frog.
- Illegal persecution and harvest occurs for gray wolf, grizzly bear, bald eagle and migrating and spawning fish species of concern.
- Woodland caribou appear excessively vulnerable to predation, especially by cougar.
- Bull trout are susceptible to overharvest.

Lack of biological information on species and habitats:

- Adequate information is lacking on the population status of state candidate species including Townsend's big-eared bat, wolverine, northern goshawk, golden eagle, flammulated owl, Vaux's swift, Lewis' woodpecker, black-backed woodpecker, pileated woodpecker, western toad, Columbia spotted frog, bull trout and silver-bordered fritillary.
- Information is needed on habitat associations, demography, or food habits for lynx, fisher, Lewis' woodpecker and pileated woodpecker.
- Conservation needs of northern leopard frogs are poorly understood.
- Additional distribution data are needed for pygmy nuthatch, western toad and bull trout.
- Information is needed on the causes of decline for western toads.
- Impacts of various land use practices are not understood for the Columbia spotted frog.
- Better information is needed on the amount of gene flow among bull trout populations.
- There is a shortage of adequate spatial inventory and assessment data on most habitat types.
- There is an absence of baseline data on the habitat values and functions of natural wetlands and a poor understanding of the status of resident macroinvertebrates in aquatic systems.

Habitat loss, conversion, fragmentation and degradation:

- Habitat fragmentation is a major problem. A number of transportation corridors interrupt migration passage for large mammals, and many of the intermountain valleys have been degraded or are threatened with new construction, mines and timber harvesting.
- Only 15% of eastern Washington forests are currently in the old growth age class, and nearly all of it is in high elevation national forests or national parks. Maintenance of old growth forest across the landscape is important for at least 1,000 species.

- Grassy and herbaceous balds are rare patch habitats distributed in low and high elevation forests. They often have associated rare species that are vulnerable to certain forest practices and recreation.
- Loss and fragmentation of late seral coniferous forests negatively impacts fisher, woodland caribou, northern goshawk and pileated woodpecker.
- Bald eagle, golden eagle and gray wolf suffer from prey declines linked to habitat loss, degradation and fragmentation.
- Shoreline timber harvest and development may destroy nesting, foraging or roosting sites for common loon, great blue heron and bald eagle.
- Conversion of forests for residential and commercial development may eliminate habitat for northern goshawk, Lewis' woodpecker and pygmy nuthatch.
- Catastrophic large scale fires reduce the habitat available for lynx.
- Continued loss and degradation of shallow wetlands eliminates habitat for redhead and silver-bordered fritillary.
- Reclamation of abandoned mines may destroy critical maternity roosts and hibernacula for Townsend's big-eared bats.
- Degradation of streams and rivers due to inappropriate forest management, agricultural practices and human development is harmful to bull trout.
- Suburban sprawl is a concern for resource managers as indicated by the growing number of ranchettes and residential subdivisions in previously managed forest and cropland. Development often occurs near lakes or streams and poses an increased threat of fire and impacts to water quality.

Incompatible land management practices:

- Fire suppression has degraded open ponderosa pine forests and other coniferous forests used by Lewis' woodpecker and black-backed woodpecker.
- Various timber cutting, snag removal and replanting practices have degraded or eliminated habitat for a variety of species including lynx, bald eagle, flammulated owl, Lewis' woodpecker, Vaux's swift, black-backed woodpecker, pileated woodpecker and pygmy nuthatch.
- Grazing has degraded open ponderosa pine forests for Lewis' woodpecker and pygmy nuthatch.
- Flammulated owls experience declining food availability after the application of forest pesticides that kill non-target moths.
- Changes in fire regime reduce the quality of nest sites and availability of food for pygmy nuthatches.
- Modern agricultural practices often reduce the quality, patch size and connectivity of wildlife habitat in farmlands.

Alien and invasive plant and animal species:

- Predation by introduced bullfrogs, bass and other fish negatively impacts pygmy whitefish, northern leopard frog and Columbia spotted frog.
- Introduced carp and mosquitofish degrade habitat for northern leopard frog and Columbia spotted frog.
- European starlings compete with Lewis' woodpecker for nest cavities.
- Non-native fish such as brook trout and rainbow trout may pose a threat to bull trout and westslope cutthroat through competition, hybridization and predation.
- Reed canary grass thrives in reservoirs, wetlands and stream outlets where water levels fluctuate, and directly affects habitats that support 27 Washington state-listed plant species. A number of native fish, amphibians and other wildlife species are not well adapted to spawn or reproduce in reed canary grass thickets.

Human disturbance and recreational impacts:

- Backcountry recreation such as motorized vehicles, hiking and skiing may disturb or displace grizzly bear, wolverine, lynx, woodland caribou, golden eagle and peregrine falcon.
- Recreational boating and fishing disturbs or displaces nesting or foraging birds such as common loon, great blue heron, redhead and bald eagle.
- Human disturbance and vandalism disrupt the maternity roosts and hibernacula of Townsend's big-eared bats located in caves and mines.
- Encroachment of human residential and recreational development can force golden eagles from suitable nesting sites.
- Nesting peregrine falcons are vulnerable to disturbance from human activities such as blasting and timber cutting.
- Recreational activities such as offroad recreational vehicles, horses, mountain bikes, and even hikers can create unauthorized trails that disturb soil and allow invasive plants to establish.
- The nature and timing of agricultural practices may be increasingly hazardous to wildlife. Tilling, planting and harvesting are becoming more synchronous, widespread and intense, thus potentially stressing wildlife during critical periods of nesting, rearing and dispersal.

Environmental contaminants:

- Ingestion of lead fishing sinkers by common loons and lead shot by bald eagles and golden eagles results in lead poisoning.
- Runoff of agricultural chemicals into wetlands is harmful to northern leopard frogs.
- Improper application of pesticides such as rotenone used for eliminating undesirable fish species from lakes and streams may also kill pygmy whitefish.

Incompatible transportation and energy development:

- Large highway corridors such as Highways 20 and 31 and associated development fragment suitable habitat and create barriers or impediments to movement for grizzly, gray wolf, wolverine and lynx.
- Roads may facilitate winter competition between lynx and coyotes.
- Roads placed near great blue heron rookeries may result in site abandonment.
- Roads located near breeding sites may cause highway mortality in western toads.
- Golden eagles and other raptors can be electrocuted on power lines.

Inadequate water quantity and quality:

- Altered hydrology may eliminate habitat for Columbia spotted frog and inland redband trout.
- Declining beaver populations in some areas and the subsequent loss of beaver ponds has reduced habitat for Columbia spotted frogs.
- Increased water temperature and sedimentation caused by improperly managed logging, agriculture and other activities may harm inland redband trout and pygmy whitefish.
- Dams and other passage barriers limit the movement of bull trout.

CONSERVATION ACTIONS

Conserve and recover wildlife species and populations: includes population management, protection of known populations, population augmentation and or reintroduction, control and monitoring mortality, enhancement of food sources/prey.

- Implement recovery actions for grizzly bear, gray wolf, lynx, woodland caribou and bull trout.
- Prepare recovery plans for the northern leopard frog and gray wolf.
- Complete the Washington Bat Conservation Plan.
- Develop management plans for state sensitive species such as common loon, peregrine falcon and pygmy whitefish.
- Prepare interagency management response guidelines for wolves to document sightings and address conflicts.
- Develop habitat management recommendations for the silver-bordered fritillary.
- Work with Canadian authorities to translocate woodland caribou in to the Selkirk Mountains.
- Reduce potential mortality in grizzly bears from accidental shooting by conducting programs to educate bear hunters on proper identification of black bears and grizzly bears.
- Conduct translocations of fisher and northern leopard frog into areas of appropriate habitat if indicated by recovery plans and feasibility studies.
- Increase harvest of cougars in and adjacent to recovery areas for woodland caribou if needed.
- Implement salmon recovery strategies to enhance the prey base for bald eagles.
- Establish and implement fisheries management objectives that are compatible with bull trout recovery.

Conduct research, assessment and monitoring: includes species and habitat distribution, abundance, limiting factors, suitable habitat and population trends.

- Determine the status of candidate species including Townsend's big-eared bat, wolverine, northern goshawk, golden eagle, flammulated owl, Vaux's swift, Lewis' woodpecker, black-backed woodpecker, pileated woodpecker, western toad, Columbia spotted frog and silver-bordered fritillary.
- Monitor populations of grizzly bear, gray wolf, lynx and bull trout to determine whether recovery objectives are being met.
- Monitor post-downlisted populations of peregrine and bald eagles for signs of decline that could result from bioaccumulation of contaminants or other factors.
- Seek reports of incidental sightings of grizzly bear and gray wolf.
- Gather distribution and abundance data on Townsend's big-eared bat, pygmy nuthatch, northern goshawk, western toad, northern leopard frog and Columbia spotted frog.
- Identify roost sites and hibernacula of Townsend's big-eared bat.
- Conduct habitat selection studies at multiple spatial scales for flammulated owl, Vaux's swift, Lewis' woodpecker, black-backed woodpecker and Columbia spotted frog.
- Evaluate the population demography of flammulated owl and Lewis' woodpecker.
- Track habitat availability for black-backed woodpecker using remote sensing techniques.
- Develop survey protocols to monitor the abundance of great blue herons.
- Evaluate whether existing forest management prescriptions are adequate to maintain populations of lynx and pileated woodpeckers.

- Evaluate habitat suitability and develop habitat management recommendations for northern leopard frogs.
- Determine the amount of genetic diversity and gene flow among bull trout populations. Monitor any colonizing wolves to determine establishment of packs and habitat use.
- Investigate the taxonomy of western toad using genetic techniques and other analyses.
- Assess and map important habitats and areas of high biodiversity in the ecoregion using ecoregional assessments, local habitat assessments, Interagency Vegetation Mapping Project, and other habitat inventories and plans. Update ecoregional assessments every five years.
- Develop statewide land cover and threats data layers to improve connectivity between priority conservation areas.
- Identify and assess key connectivity areas and wildlife corridors between fragmented habitats and between protected areas. Restore habitat connectivity and wildlife corridors where appropriate on both public and private lands.
- Improve understanding of the ecological processes of seeps, bogs, wet meadows, forested wetlands, marshes, springs and other wetlands, and how they are impacted by human development.
- Conduct hydrologic studies that include water quantity and chemical budgets at wetlands known to be supporting rare and endangered species. Use this information to inform wetland management.
- Inventory and prioritize riparian habitat types and attributes needing protection and conservation.
- Identify important habitats for restoration and assess the feasibility of successfully restoring these sites. Include an evaluation of current and projected land use in and adjacent to potential restoration sites.

<u>Protect, restore and connect habitats</u>:

- Protect rare habitat types such as grassy and herbaceous balds, aspen stands, snag patches, caves, cliffs and talus.
- Maintain mature and late successional coniferous forests from harvest to protect fisher, woodland caribou, northern goshawk, flammulated owl, Vaux's swift and black-backed woodpecker.
- Provide input on timber harvest and fire management activities on state, private and federal lands to perpetuate adequate amounts and distribution of denning and foraging habitats for ***lynx***.
- Maintain and restore open ponderosa pine forest to enhance populations of golden eagle, Lewis' woodpecker and pygmy nuthatch.
- Maintain and restore mature cottonwood riparian forests with large diameter snags for Lewis' woodpeckers.
- Protect and restore riparian areas for inland redband trout and bull trout.
- Protect important calving sites for woodland caribou.
- Protect important roost sites and hibernacula for Townsend's big-eared bats.

- Protect suitable breeding lakes for common loons and redheads from development and recreational pressure.
- Protect ponds, lakes, creeks and wetland margins with known populations of Columbia spotted frogs.
- Protect land near large great blue heron colonies through fee title land purchases or conservation easements.
- Work with county planners to establish reserve areas of open forests and woody riparian corridors for Lewis' woodpecker.
- Protect important areas of ungulate winter range through acquisitions, easements and agreements to provide adequate prey populations for gray wolves.
- Conserve prey populations of golden eagles by reducing deliberate control programs.
- Manage small fish populations in lakes with nesting common loon.
- Work with the Washington Department of Natural Resources to maintain and enforce Forest Practice rules protecting bald eagle roost sites and nests.
- Continue to require bald eagle habitat plans that require retention of trees.
- Prioritize conservation areas using ecoregional assessments and other biological assessments. Protect important habitat types, biodiversity areas and environmentally sensitive lands that should not be altered through a variety of techniques including acquisitions, conservation easements, life estates and cooperative agreements with willing landowners.
- Coordinate with local land trusts, conservation districts and other conservation organizations and agencies to conserve important habitat on both public and private land. Focus limited resources in regionally significant areas. Identify all possible acquisition and restoration grants and coordinate applications.
- Work with the USDA Forest Service and other public landowners to protect existing roadless areas and expand the roadless area network where justified for habitat protection and connectivity.
- Protect key connectivity areas and wildlife corridors between fragmented habitats and between protected areas through a variety of techniques including acquisitions, conservation easements, life estates and cooperative agreements with willing landowners. Use statewide land cover and threats data layers to improve connectivity between priority conservation areas.
- Restore native habitats, habitat connectivity and wildlife corridors where appropriate on both public and private lands. Consider restoring lands adjacent to existing protected areas to increase their effective size and function as wildlife habitat.
- Purchase water rights from willing sellers in unregulated tributaries; use these water rights to restore and maintain adequate year-round flows for both instream and out-of-stream riparian fish and wildlife habitat.
- Rehabilitate and restore stream channels, floodplain functions, riparian habitat and connectivity where streams have been diverted, fragmented or degraded. Use livestock exclusions, instream structures, bank modifications and other methods.
- Preserve and/or restore buffer areas in appropriate locations along tributaries and mainstem waterways to a condition that is adequate to maintain healthy, functioning riparian zones for the ecoregion's rivers.

Improve land management practices:

General

- Restore degraded ponderosa pine forests by thinning dense understory fir, encouraging longer harvest rotations, returning to natural fire regimes and maintaining snags to enhance populations of northern goshawk, flammulated owl, Lewis' woodpecker and pygmy nuthatch.

- Promote forest management practices that improve habitat connectivity and facilitate dispersal for grizzly bear, gray wolf, wolverine, lynx and woodland caribou.
- Allow wildfires to burn in some forests to create suitable habitat for black-backed woodpeckers.
- Encourage and assist landowners to exclude cattle from grazing in riparian forests to protect habitat for Lewis' woodpecker, inland redband trout and other riparian-dependent wildlife.
- Allow natural disturbances and successional functions and processes to occur on conserved wetlands.
- Work with public land management agencies to manage publicly-owned land for conservation of Species of Greatest Conservation Need and associated priority habitats.

Fire management

- Work with public agencies and private landowners to reduce the potential destructive impact of wildfires on native habitats by incorporating measures such as fire breaks and prescribed burning into wildlife and land management plans.
- Coordinate with public land managers on the use of controlled fire regimens and stand management practices. Attempt to simulate natural disturbance regimes and restore proper ecological functions. Consider impacts to local wildlife in each burn plan, including timing, size and location of the burn.

Forest practices

- Work with public and private landowners to protect remaining old growth conifer and hardwood stands to benefit late successional species and manage some stands on long rotations (>200 years).
- Work with the Forest Practices Board and both public and private forest landowners to properly design and implement current forest practices rules, including the Forests and Fish Agreement to protect fish, wildlife and habitat.
- Work with the Department of Natural Resources and the State Forest Practices Board to develop, implement and enforce forest practices regulations to enhance biological diversity on existing state and private managed and protected areas.
- Work through the Forest Practices Board and directly with forest landowners to implement forest management prescriptions, including prescribed burns, which will maintain and enhance biodiversity and natural ecosystem functions. Encourage modified silvicultural prescriptions that promote local topographic, soil and vegetative conditions. Retain snags, downed woody debris and a complement of live trees in harvested areas. Sensitive areas such as wetlands, remnant old growth and wildlife breeding sites should not be disturbed.
- Encourage the development of selective harvest policies and guidelines on both public and private forest land that will leave adequate components of old growth habitat such as snags and downed wood and some live trees as habitat for associated wildlife such as northern goshawk, Vaux's swift, flammulated owl, Lewis' woodpecker, black-backed woodpecker and pileated woodpecker.
- Work through the Forest Practices Board and public and private landowners to minimize logging roads and decommission them after the period of entry. Ensure that forest practices rules are followed by locating logging and forest access roads in stable, non-erodible areas and outside riparian management zones.
- Work to ensure that forest practices rules are followed by maintaining adequate riparian management zones along streams in all logging sites, on both public and private land.

- Support implementation and enforcement of the Washington Forest Practices Act to accomplish habitat conservation and regeneration on both state and private forest lands.
- Encourage public and private forest landowners to manage forested watersheds that maintain an appropriate mix of successional stages and provide connectivity of riparian and upland vegetation as protected travel corridors for wildlife.

Grazing and agricultural practices

- Work with public, tribal and management agencies to fence or otherwise protect riparian zones from livestock grazing and unauthorized offroad vehicle use. Consider retirement rather than renewal of grazing leases on sensitive lands. Work through the Forest Practices Board and public and private landowners to minimize logging roads and decommission them after the period of entry. Ensure that forest practices rules are followed by locating logging and forest access roads in stable, non-erodible areas and outside riparian management zones.
- Work to ensure that forest practices rules are followed by maintaining adequate riparian management zones along streams in all logging sites, on both public and private land.
- Work with conservation districts, Natural Resource Conservation Service, USDA Forest Service and private landowners to implement best management practices in riparian areas and associated upland habitat in conjunction with the Conservation Reserve Program, Wetland Reserve Program and other Farm Bill Programs.
- Use the Comprehensive Resource Management Plan process for large landscapes with a mix of public and private landowners to modify grazing regimes and improve grassland understory conditions and enhance biodiversity.
- Assist private landowners in securing funding to fence riparian zones on private land. In areas where it is impractical to exclude livestock, protect habitat quality by controlling the timing and intensity of livestock grazing through regulation and landowner agreements.
- Work with private and public landowners to minimize the impacts on habitat and wildlife from modern agriculture, including agrochemical use, water use and soil erosion.

<u>Control and prevent introduction of alien and invasive species</u>:

- Develop methods to control or otherwise mitigate impacts of introduced bullfrogs and fish on ***northern leopard frog*** and Columbia spotted frog.
- Monitor lakes, streams and wetlands for illegal fish introductions and prohibit legal introductions to protect pygmy whitefish, northern leopard frog and Columbia spotted frog.
- Avoid introduction of non-native fish in fishless lakes and where species of conservation concern occur such as bull trout, westslope cutthroat trout, native amphibians and reptiles, avoid introduction of rainbow trout or only introduce sterile fish where westslope cutthroat are found. Avoid introduction of non-native trout to protect bull trout from hybridization, competition and predation.

- Determine extent of competition for cavities between Lewis' woodpeckers and European starlings, and control starlings if necessary.
- Develop a regional plan for the detection, rapid response and eradication of invasive species.
- Work with other public agencies and private agricultural organizations such as the Farm Bureau and Washington Grange to develop basic techniques for mapping and monitoring the spread of invasive plant species over time.
- Participate in federal and state agency partnerships to develop and implement weed control strategies for impacted sites and ecosystems. Promote adequate funding and coordination of weed control efforts on both public and private lands using environmentally sound methods.
- Develop educational and public information materials to increase public awareness of the ways that invasive alien species are introduced to sensitive ecosystems.
- Provide funding, incentives and technical assistance to private landowners to eliminate undesirable invasive plant species in riparian zones and to restore native plants that provide important habitat for native fish and wildlife. Use integrated pest management practices to control currently established invasive species with help from volunteers.
- Participate in federal and state agency partnerships to develop and implement weed control strategies for impacted sites and ecosystems.

Control and monitor disturbance:

- Limit disruptive types of recreational activity in roadless, wilderness and primitive areas to prevent disturbance of grizzly bear, wolverine and ***woodland caribou***.
- Limit access to roost and hibernacula sites for Townsend's big-eared bat.
- Minimize disturbance of great blue heron, bald eagle, golden eagle and peregrine falcon nests from human activities such as development, logging, boating and other recreational activity by restricting access to public lands as needed, working with permitting agencies to reduce levels of disturbance and informing the public of sensitive areas and periods.
- Eliminate vehicular access and campsites in conservation areas identified as sensitive habitats, such as montane wetlands and bogs.
- In sensitive habitats, manage both land and water access by using fencing, trails, elevated boardwalks, railings, seasonal restrictions, signage and livestock restrictions.
- Reduce the amount and impact of unauthorized recreational access and use on important wildlife habitat through better enforcement of existing laws, more fencing and posting of critical habitat areas, selective road closures and increased public education and information for recreational users and user groups.

- Protect nesting golden eagles, bald eagles, peregrine falcons and prairie falcons through use and access restrictions on public lands as needed, and work with private landowners and permitting agencies to prevent blasting or construction disturbance during nesting. Inform rock climbers of sensitive periods and locations to reduce disturbance of nesting peregrines, golden eagles and prairie falcons.

Control and prevent environmental contamination:

- Protect common loon, bald eagle and golden eagle from lead poisoning by advocating the use of nontoxic fishing sinkers and steel shot.
- Evaluate the need for contaminant studies in northern leopard frogs.
- Restrict the use of fish pesticides such as rotenone in waters with common loon and pygmy whitefish.
- Work with other agencies to reduce and remediate sources of contaminants that contribute to prey contamination for bald eagles, peregrine falcons, etc.
- Work with governmental and nonprofit agencies to develop an ecoregion-wide strategy for identified toxins and other pollutants: their sources, destinations and effects, and ways to reduce their discharge.
- Work with other agencies, industry and private landowners to encourage use of integrated pest management techniques and phase out the use of pesticides and herbicides.
- Clean up contaminated sites and sediments wherever possible and prevent further toxic contamination of areas, including unconfined spoil disposal sites.
- Reduce the use of hazardous chemicals by continuing to implement the persistent bioaccumulative toxins strategy and by using a variety of best management practices and improved treatment methods.
- Continue to place a priority on actions to prevent and respond to oil and hazardous material spills.
- Facilitate use of nontoxic alternatives to lead shot and lead fishing sinkers.

Improve transportation and energy development:

- Power lines near breeding and foraging areas should be built or modified to reduce the occurrence of golden eagle and other raptor electrocutions.
- Highway overpasses and underpasses should be constructed to facilitate access to suitable habitats for grizzly bear, gray wolf and wolverine.
- Reduce road mortality in western toads by providing road crossings near breeding sites.
- Work with the Washington Department of Transportation to locate highways way from important wildlife habitats and biodiversity areas. If impacts are unavoidable, design adequate mitigation such as underpasses, overpasses and fencing to accommodate wildlife such as western toads that need passage.

Improve water quantity and quality:

- Provide floating nest platforms for common loons at lakes with fluctuating water levels.
- Conserve beaver populations, beaver ponds and dynamic stream processes in areas with Columbia spotted frogs.
- Reduce the impacts of land use practices that increase water temperature and sedimentation, thereby harming inland redband trout and pygmy whitefish.
- Improve water quality at potential northern leopard frog recovery areas.

- Manage wetland areas on public land for both high water quality and habitat value. Ensure that the water quality of inflow does not lead to deterioration of the wetland habitat.
- Where possible, restore or rehabilitate the hydrology, water quality and native plant communities in degraded and disturbed wetlands. Methods should emphasize creating or restoring natural wetland functions such as beaver populations and dynamic stream processes to benefit species such as the northern leopard frog, Columbia spotted frog and silver-bordered fritillary.
- Manage runoff from highways according to the updated highway runoff manual. Improve the road drainage network in riparian zones by removing unnecessary culverts, increasing the size of inadequate culverts or replacing culverts with bridges.
- Reduce the harm from stormwater runoff by working to improve the effectiveness of the National Pollutant Discharge Elimination System stormwater permit programs.
- Assist local jurisdictions in finding solutions to increase landowner compliance with onsite sewage system maintenance and animal waste management practices through education and regulated inspection. Work to reduce the number and volume of combined sewer overflow events.

<u>Improve coordination, planning, permitting and mitigation</u>:

- Strengthen the Shoreline Management Act to protect bald eagle nesting and roosting sites.
- Provide credible scientific information on priority habitats and species and biodiversity areas, their significance, management needs and compatible land uses to decision-makers at site, local and regional scales.
- Provide technical assistance to counties in using fish and wildlife and biodiversity information to update comprehensive land use plans, community or watershed plans, Shoreline Master Plan, etc.
- Assist counties in developing and updating county ordinances and incentives that help to mitigate or control development in areas with resource and conservation values and that encourage environmentally sensitive development in growth areas.
- Work with local governments and conservation organizations to identify and protect areas of important habitat and biodiversity through existing environmental laws and other local programs.
- Encourage floodplain management and shoreline zoning protection programs.
- Develop a coordinated conservation vision and strategy for conservation of large landscapes using a structured process like The Nature Conservancy's 5-S Project Management System or the Cascade Dialogs.
- Represent WFW conservation interests on interagency recovery teams and working groups.
- Review state and federal land management plans to ensure adequate protection for priority habitats and species, biological diversity and ecosystem health.
- Develop site management plans for protected areas.
- Work with public and tribal land management agencies to protect important habitat and areas of high biodiversity from loss and fragmentation as well as degradation.
- Coordinate and integrate species recovery and management plans with land management and watershed plans using regulatory and voluntary approaches.
- Participate in Growth Management Act, shoreline Management Act, Forest Protection Act and Federal Energy Regulatory Commission permitting processes for new or expanded residential, recreational or hydropower development on private land.
- Use information from ecoregional assessments to illustrate important habitats and areas of high biodiversity. Encourage permitting agencies to designate and protect

these areas from residential and recreational development, and to require mitigation for habitat conversion and fragmentation where it occurs.

- Work closely with the USDA Forest Service and other land management agencies to prevent or mitigate potential adverse impacts to fish and wildlife habitat from proposed recreational or hydropower development on public lands.
- Work with regulatory agencies to design effective mitigation strategies for projects that result in wildlife impacts or direct conversion or fragmentation of habitat.
- Assist federal agencies in implementing the Interior Columbia Basin Ecosystem Management Strategy.

Improve enforcement of laws and regulations:

- Enforce existing protections for grizzly bear, gray wolf and bald eagle through vigorous investigation and prosecution.
- Enforce fishing regulations, seasons and stream closures to protect bull trout from fishing pressure.
- Maintain conservative hunting regulations for redhead.
- Enforce recreational access restrictions on public lands and aquatic areas.

Improve landowner assistance:

- Work with landowners to maintain sufficient foraging habitat, travel corridors and denning sites for lynx.
- Work with large and small timber companies and landowners to accomplish habitat conservation through nonregulatory approaches such as landowner incentives, conservation easements, habitat conservation plans and acquisition of critical habitat from willing landowners.
- Secure state and federal tax incentives that discourage habitat fragmentation and destruction and that encourage landowners to protect and manage their land to benefit wildlife habitat.
- Work with local government to implement the Public Benefit Rating System and encourage effective use of open space tax incentives for landowners.
- Work with private landowners to identify and protect areas with important habitats and biodiversity and protect these areas through landowner incentives and other nonregulatory programs. This would assist species such as great blue heron, northern pintail, redhead, bald eagle, flammulated owl, Vaux's swift, Lewis' woodpecker, western toad, northern leopard frog, Columbia spotted frog and ***silver-bordered fritillary.***

- Provide educational materials to private landowners that describe management techniques for maintaining and restoring various wildlife habitats.
- Work with private landowners to identify and protect important wetland habitats and buffers by providing adequate water, controlling invasive plants, reducing disturbance to nesting wildlife and fencing or otherwise keeping livestock out of wetlands and associated upland habitat.
- Influence the application of federal Farm Bill funds, including the Conservation Reserve Program and the WDFW Landowner Incentive Program, on private

agricultural lands most critical for wildlife movement and most suitable for restoration of native wetlands and grassland habitat.
- Promote grant programs to assist landowners with implementation of management plans.
- Develop, periodically update and provide WDFW Priority Habitats and Species management recommendations to assist landowners in conserving priority habitats and species.

Improve wildlife conservation education: includes outreach, volunteer and watchable wildlife programs.

- Conduct outreach and education programs to engage the public in conservation programs for many species such as gray wolf, grizzly bear, lynx and bull trout.
- Continue to support volunteer programs for monitoring common loon activity at lakes.
- Implement education programs to curtail recreational pressure on common loons and redheads at suitable breeding lakes.
- Provide educational materials to hunters to prevent accidental mortality and harassment of lynx, gray wolf, caribou and grizzly bear.
- Engage and involve local and tribal governments, state and federal agencies, organizations and citizens in efforts to protect and restore priority habitats and species through a variety of outreach projects, programs and education efforts.
- Increase the use of citizen science for the collection of data, monitoring, restoration and conservation of important habitats and associated wildlife species. Coordinate volunteer monitoring and involvement.
- Promote and maintain public information and education efforts that focus on endangered species, habitat loss, ecological function, biological diversity and environmentally-aware lifestyle practices. Emphasize the connection between habitat and environmental quality and human health and welfare.
- Expand conservation education programs for both adults and children to emphasize the critical nature and vulnerability of sensitive habitats such as wetlands, oak and grassland habitats and associated wildlife.
- Connect with user groups through education to make them part of the conservation solution in areas that have high recreation values.
- Work with large corporations to increase awareness and develop financial support for conservation of biodiversity.

Gray wolves.

BLUE MOUNTAINS ECOREGION

PHYSIOGRAPHY AND FISH AND WILDLIFE DIVERSITY

Geography

The Blue Mountains ecoregion extends from adjacent Idaho and Oregon into the southeast corner of Washington. It includes the Grande Ronde and Snake River canyons northward to just south of Clarkston. Approximately one percent of Washington is within this ecoregion. This overall area has experienced relatively low human impact; agricultural and urban development has concentrated along the Grande Ronde River.

Geology

The Blue Mountains were formed by the uplifting of Columbia River basalt flows. The Grande Ronde and Snake Rivers incised deep canyons to form the dramatic topography that characterizes the ecoregion today. Typical elevation ranges from 2,000 to 4,000 feet, with the highest peak, Mt. Misery, at 6,387 feet and the lowest elevation at 750 feet along the Snake River. Windblown silts and volcanic ash cover most of the plateaus, providing a rich soil base.

Climate

Annual precipitation ranges from less than 10 inches in the canyon of the Grande Ronde River to more than 50 inches 25 miles to the west in the Wenaha-Tucannon Wilderness Area. Most of the ecoregion is within a 14- to 24-inch precipitation zone. Much of the precipitation appears as snow, although fall and spring rains are common, often creating flood events.

Habitat and Plant Associations

The Blue Mountains ecoregion is relatively intact, dominated by natural or semi-natural vegetation. A majority of the region is covered by coniferous forest, but because of its abrupt topography and wide elevation ranges, it also supports native grasslands and shrublands along low, dry canyons, on broad plateaus and in subalpine meadows. Douglas-

fir/ponderosa pine forests are found at low and middle elevations, with subalpine fir/Engelmann spruce occurring at higher elevations. Western larch, lodgepole pine and western white pine comprise mesic forests. The Blue Mountains and Snake River canyon together host a number of endemic snail species. Canyon grassland vegetation occurs on the steep slopes above the Grande Ronde and Snake Rivers and is interlaced with plateau grasslands. Dense shrublands populate the higher canyons along the Oregon-Washington border. Numerous springs are scattered throughout the ecoregion, and alpine lakes are clustered at some of the high elevations.

Fish and Wildlife Diversity

An estimated 246 wildlife species reside in the Washington portion of the Blue Mountains. Of these, 84 are closely associated with wetland habitat. Nine species are listed under the federal Endangered Species Act and 43 are listed by Washington as threatened, endangered or candidate species. Large mammals common in the Blue Mountains include Rocky Mountain elk, mule deer, black bear, cougar, bobcat and coyote. Several furbearers are common, including beaver, marten and raccoon. Golden eagles, owls and a wide assortment of songbirds and raptors inhabit cliffs and talus slopes. Cavity nesters such as woodpeckers, nuthatches, chickadees and bluebirds are distributed throughout the ecoregion. Anadromous fish include chinook and coho salmon and steelhead, but local populations are at diminished levels and many have been added to federal or state threatened or endangered species lists.

LAND OWNERSHIP

Most of the Blue Mountains ecoregion is held and managed by federal and state agencies. The Umatilla National Forest covers over half (52%) of Washington's portion of the ecoregion, while land managed by the Bureau of Land Management makes up about nine percent. The Washington Department of Fish and Wildlife manages about 32,895 acres in the foothills and canyons of the Blue Mountains, including the William T. Wooten, Asotin, and Chief Joseph Wildlife Areas.

Thirty-four percent of the ecoregion is private land. Aside from a few mining claims in the mountains, private land holdings are concentrated in the river valley bottoms, which contain the best soils and access to water. The only large industrial landowners are timber companies.

Recently, major changes have occurred in the composition of the rural population and land uses in the Blue Mountains. The region is being discovered as more and more town and city residents are seeking rural home sites. Some agricultural lands with easily eroded soils have been temporarily removed from crop production under the federal Conservation Reserve Program. Figure 32 maps land ownership classes in the Blue Mountains ecoregion.

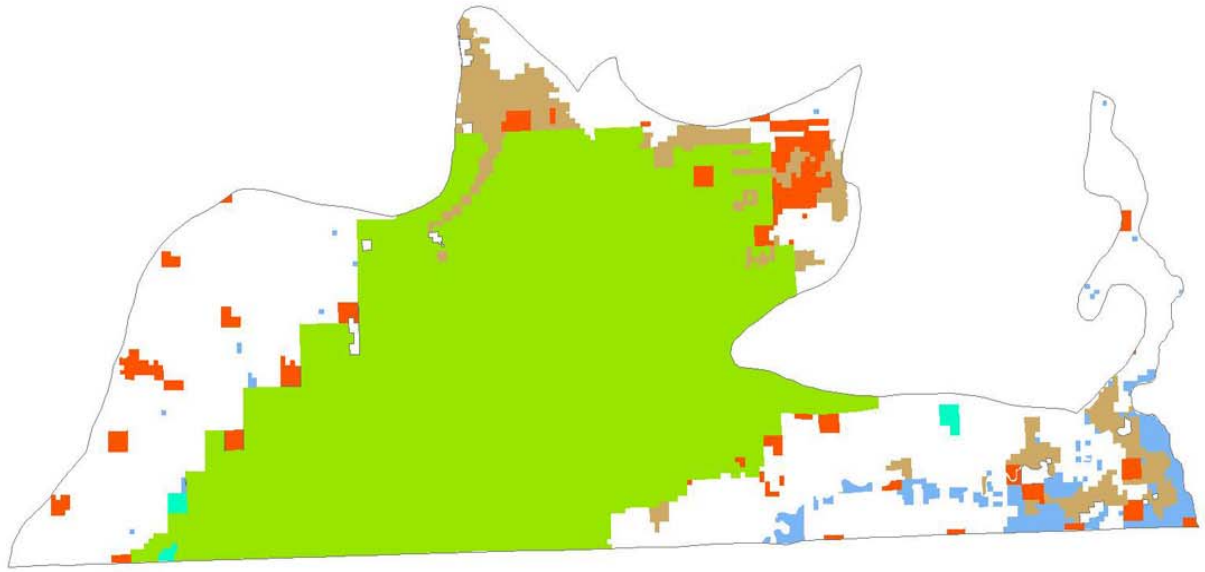
Blue Mountains Ecoregion
Land Ownership Classes
USFS
NPS
Other Federal
WDFW
WDNR
Other State/County/City
Tribal
Private

Figure 32.

ECOREGIONAL CONSERVATION PARTNERSHIPS

Effective conservation of fish, wildlife and biodiversity in Washington requires close coordination and cooperation with many public and private conservation partners. Some major partners in the Blue Mountains ecoregion include:

- Asotin, Garfield and Columbia Counties
- U.S. Bureau of Land Management
- USDA Forest Service (Umatilla National Forest)
- Washington Department of Natural Resources (WDNR)
- Washington State Parks and Recreation Commission

The Washington Department of Fish and Wildlife also works closely on conservation projects with private conservation partners such as The Nature Conservancy, Trust for Public Land, Rocky Mountain Elk Foundation, Audubon Washington, Ducks Unlimited and a growing number of fisheries enhancement groups and local land trusts.

Major Plans and Assessments

A number of ongoing or completed planning efforts involving WDFW and its public and private partners guide the conservation and management of fish and wildlife resources statewide and in the Blue Mountains ecoregion. Important planning efforts affecting conservation in the Blue Mountains ecoregion include:

- Asotin, Tucannon, Walla Walla and Grande Ronde Subbasin Plans (2004)
- Blue Mountains Ecoregional Assessment
- Interior Columbia Basin Ecosystem Management Project
- Intermountain West Joint Venture Coordinated Bird Conservation Plan (2005)
- Land and Resource Management Plan (Umatilla National Forest)
- USFWS Draft Bull Trout Columbia River DPS Recovery Plan (2004)
- Washington Forest Practices Board Wildlife Strategy (in progress)
- Washington Forests and Fish Agreement (1999)
- WDFW Bald Eagle Status Report (2001)
- WDFW Bull Trout and Dolly Varden Management Plan (2000)
- WDFW Draft Blue Mountain Regional Wildlife Area Management Plan
- WDFW Game Management Plan (2003)
- WDFW Margined Sculpin Status Report (1998)
- WDFW Outline for Salmon Recovery Plans (2003)
- WDFW Peregrine Falcon Status Report (2002)

Supporting references to these and other important statewide planning documents are included at the end of this chapter and/or in Appendices 6 and 7.

SPECIES AND HABITATS OF GREATEST CONSERVATION NEED

This section provides a short summary of priority species and associated habitats for the Washington portion of the Blue Mountains ecoregion.

Species of Greatest Conservation Need

The following species list for the Blue Mountains ecoregion is a regional subset of the statewide Species of Greatest Conservation Need (SGCN) list shown in Appendices 1 and 2. The process and criteria used to develop the statewide SGCN list are provided in Volume Two: Approach and Methods, as well as in Appendix 3. Species listed below are found in the Blue Mountains ecoregion for all or part of their lifecycle. Supporting tables and information for these species and habitats can be found in Chapter IV and in Appendices 1, 2, 8, 9, 10 and 14.

	Population Size/Status						Population Trend					
COMMON NAME	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown	State Status*	WNHP**
Mammals												
Preble's shrew	?		?			x				x	N	S1
Merriam's shrew			x							x	C	S3
Townsend's big-eared bat			x							x	C	S3
Gray wolf	?									x	E	S1
American badger			x				x				G	S4
Birds												
American white pelican			x						x		E	S1
Great blue heron			x							x	M	S4
Bald eagle				x					x		T	S4
Northern goshawk			x							x	C	S3
Golden eagle			x							x	C	S3
Peregrine falcon			x						x		S	S2
Prairie falcon			x							x	M	S3
Mountain quail			x							x	G	S1
Flammulated owl			x							x	C	S3
Burrowing owl			x				x				C	S2
Great gray owl			x							x	M	S2
Vaux's swift			x				x				C	S3
Lewis' woodpecker			x				x				C	S3
White-headed woodpecker			x				x				C	S2
Black-backed woodpecker			x							x	C	S3

COMMON NAME	Population Size/Status						Population Trend				State Status*	WNHP**
	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown		
Pileated woodpecker				x						x	C	S4
Pygmy nuthatch			x							x	N	S3
Reptiles												
Pygmy horned lizard				x						x	N	S3
Sagebrush lizard			x				x				C	S2
Amphibians												
Rocky Mountain tailed frog				x			x				C	G4
Western toad				x			x				C	S3
Columbia spotted frog			x							x	C	S4
Fish												
River lamprey						x				x	C	S2
Pacific lamprey						x				x	N	S3
Margined sculpin				x						x	S	S1
Westslope cutthroat				x				x			G	G4
Snake River steelhead											C	G5
Inland redband trout						x				x	G	G5
Bull trout						x				x	C	G3
Leopard dace						x				x	C	S2
Mountain sucker						x				x	C	S2
Invertebrates												
Columbia River tiger beetle	?									x	C	S1
Mann's mollusk-eating ground beetle			x				x				C	
Shepard's parnassian (butterfly)			x							x	C	S1
Juniper hairstreak (butterfly)						x				x	C	S2
Winged floater (bivalve)			x				x				N	G3
Oregon floater (bivalve)			x				x				N	S3
Western ridged mussel			x				x				N	S2
Western pearlshell				x			x				N	S4

* Status Codes	** WNHP Codes (S = state, G = global)
E = endangered	1 = critically imperiled
T = threatened	2 = imperiled
S = sensitive	3 = vulnerable to extirpation or extinction
C = candidate	4 = apparently secure
M = monitor	5 = demonstrably widespread, abundant and secure

Species Conservation in the Blue Mountains Ecoregion

Species of Greatest Conservation Need (SGCN) found in the Blue Mountains ecoregion (see table above) include those classified by WDFW as Endangered, Threatened, Candidate or Monitor species, as well as species identified by WDFW as needing additional research or funding attention. Conservation actions are recommended for these SGCN species at both the statewide and ecoregional levels. These recommended conservation actions are summarized in a series of matrices included in Chapter IV and as Appendices 9 and 10. These matrices also display the life history, population status and distribution of these species.

Ecoregional Habitat Overview

Dramatic changes in wildlife habitat have occurred throughout the Blue Mountains ecoregion since pre-European settlement. The most significant habitat changes include the loss of some herbaceous wetlands, ponderosa pine habitat, and Eastside (Interior) grassland habitat. Significant changes have occurred in other habitat types as well. Mixed conifer forest habitats have increased considerably over the past 150 years due to logging, wildfires, fire suppression and forest management practices, which have promoted early-succession forest conditions that favor mixed conifer forest types over ponderosa pine forests. Figure 33 maps wildlife habitat classes in the Blue Mountains ecoregion.

The following major habitat types classified, coded and described in Wildlife and Habitat Relationships in Oregon and Washington (WHROW), are present in the Blue Mountains Ecoregion. In the next section, descriptions are provided for priority habitats associated with Species of Greatest Conservation Need found in this ecoregion.

- Montane Mixed Conifer Forest
- Eastside (Interior) Mixed Conifer Forest
- Lodgepole Pine Forest and Woodlands
- Ponderosa Pine Forest and Woodlands
- Subalpine Parkland
- Eastside (Interior) Canyon Shrublands
- Eastside (Interior) Grasslands
- Shrub-steppe
- Agriculture, Pasture and Mixed Environs
- Open Water: Lakes, Rivers and Streams
- Montane Coniferous Wetlands
- Eastside (Interior) Riparian-Wetlands

Figure 33.

Blue Mountains Ecoregion
Wildlife Habitat Classes
Westside Lowland Conifer/Hardwood
Westside Oak/Dry Douglas-Fir
Montane Mixed Conifer
Eastside Mixed Conifer
Lodgepole/Ponderosa Pine/Eastside Oak
Subalpine/Alpine Environs
Grasslands/Shrublands
Agriculture
Urban
Lakes/Rivers/Reservoirs
Wetlands
Coastal Land Environs
Bays/Estuaries

Priority Habitats in the Blue Mountains Ecoregion

The following three habitat types have been identified as the highest priority for current conservation action in the Blue Mountains ecoregion. Selection of these habitats as a priority was determined by their importance to regional Species of Greatest Conservation Need, as well as priorities outlined in the Blue Mountains Ecoregional Assessment and the subbasin plans listed in the "Major Plans" section above. More discussion on the selection of priority habitats is included in Chapter III, Statewide Overview and in Volume Two, Approach and Methods.

- Ponderosa Pine Forest and Woodlands
- Eastside (Interior) Grasslands
- Eastside (Interior) Riparian-Wetlands

Ponderosa Pine Forest and Woodlands

Ponderosa pine habitat supports the highest number of vertebrate wildlife species when compared with other Eastside forest habitats. In the Blue Mountains, ponderosa pine forms climax stands that border native grasslands; it is also a common component of many other forested communities. Ponderosa pine is a drought tolerant tree that usually occupies the transition zone between grassland and forest. Mature stands are characteristically warm and dry, and occupy lower elevations throughout their range. Understory components in mature stands typically include grasses such as bluebunch wheatgrass and Idaho fescue, and shrubs such as common snowberry.

The major defining structural feature of this habitat is open canopy forest or a patchy mix of open forest, closed forest and meadows. On flat terrain, trees may be evenly spaced. On hilly terrain, the more common pattern is a mix of dry meadows and hillsides, tree clumps, closed forest in sheltered canyons and north-facing slopes, shrub patches, open forest with an understory of grass and open forest with an understory of shrubs. Without fire suppression, the common belief is that the forest would be less heterogeneous and more savanna-like with larger, more widely spaced trees and fewer shrubs.

Selected Species Closely Associated with Ponderosa Pine Forest and Woodlands in the Blue Mountains Ecoregion

Flammulated owl	Northern goshawk
Great gray owl	Pygmy nuthatch
White-headed woodpecker	

Eastside (Interior) Grasslands

The Palouse region was once a continuous native prairie dominated by mid-length perennial grasses. Today, little more than one percent of these native grasslands remain. It is one of the most endangered ecosystems in the United States. Most of the Palouse occurs in the Columbia Plateau ecoregion; however, parts of it extend into the Blue Mountains ecoregion.

In this ecoregion, the Blue Mountain steppe vegetation zone occurs only in Asotin County; however, native grasslands have been replaced throughout most of the ecoregion by

agricultural crops or severely altered by introduction of, and subsequent competition from, introduced weeds such as cheatgrass, knapweed and yellow starthistle. Overgrazing also results in the replacement of native vegetation with native species, especially cheatgrass and yellow starthistle. Currently, native perennial bunchgrass-shrub communities are found only on a few "eyebrows" on steep slopes surrounded by wheat fields, or in non-farmed canyon slopes and bottoms within agricultural areas. The vast majority of the ecoregion's grassland habitat is either not protected or is afforded only low-protection status.

Selected Species Closely Associated with Eastside (Interior) Grasslands in the Blue Mountains Ecoregion

American badger	Merriam's shrew
Burrowing owl	Prairie falcon

Eastside (Interior) Riparian-Wetlands

Riparian habitat covers a relatively small area in the Blue Mountains ecoregion; yet it supports a higher diversity and abundance of fish and wildlife than any other habitat, provides important fish and wildlife breeding habitat, seasonal ranges and movement corridors; is highly vulnerable to alteration; and has important social values, including water purification, flood control, recreation and aesthetics.

Riparian and wetland habitats dominated by woody plants are characteristic of the Blue Mountains ecoregion. Mountain alder-willow riparian shrublands are major habitats in the forested zones. Lowland willow and other riparian shrublands occur at low to middle elevations. Quaking aspen wetlands and riparian habitats are widespread, but rarely a major component of the Blue Mountains landscape. Riparian-wetlands structure includes shrublands, woodlands and forest communities. A typical riparian habitat would be a mosaic of forest, woodland and shrubland patches along a stream course. These woody riparian habitats have undergrowth of low shrubs or dense patches of grasses, sedges or forbs. Tall shrub communities can be interspersed with sedge meadows or moist native grasslands. Intermittently flooded riparian habitat has groundcover composed of steppe grasses and forbs. Rocks and boulders are sometimes prominent.

Selected Species Closely Associated with Eastside (Interior) Riparian-Wetlands in the Blue Mountains Ecoregion

Western toad	Rocky Mountain tailed frog
Columbia spotted frog	Columbia River tiger beetle
Mann's mollusk-eating ground beetle	
Shepard's parnassian butterfly	

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CONSERVATION PROBLEMS

A number of human activities pose potential threats to the integrity of wildlife habitat. These activities include incompatible forest and grazing practices, conversion of habitat to agriculture, urbanization, dispersed residential development, pollution, overfishing and overhunting, water extraction, incompatible mining, hydropower and energy developments and transportation systems. These developments disturb and displace wildlife, disrupt migration corridors, and encourage the establishment of invasive plant and animal species.

Wetlands and riparian areas are impacted from logging, agriculture and residential development that affect shorelines, water quality, water quantity and overall habitat continuity and complexity. This leads to increased erosion, which in turn increases sedimentation. Improperly managed livestock grazing compacts soil, contributes to stream bank destabilization, affects compositions of riparian plant communities, and slows recovery of damaged riparian habitat. This loss of riparian vegetation results in greater summer heating and winter cooling of stream temperature, soil instability, reductions in water quantity and quality, and changes in bank, channel and instream structure. All of these habitat changes affect the distribution and abundance of aquatic species.

Forest Practices

Forest practices have had significant impacts on the forests of the Blue Mountains ecoregion. Past forest management practices and related land uses have disrupted or distorted many natural ecosystem functions, which in turn have affected the value and functions of these forested habitats as wildlife habitat. The future condition and value of the ecoregion's terrestrial and aquatic habitats will depend to a large degree on how intensively they are managed for timber and other uses in the future. Coordinated site-specific alterations will mostly likely yield the best results for wildlife. In any case, the issue of forest health will continue to be central to forest conservation in the ecoregion.

Fire Suppression

Fire suppression in the ecoregion's forest habitats has resulted in the degradation of late seral ponderosa pine forest communities and, in some instances, wildlife species diversity by allowing the spread of shade-tolerant species such as Douglas-fir and grand fir and an increase in density of pines. Prior to fire suppression, wildfires kept shade-tolerant species from encroaching on established forest communities. The lack of fire within forest ecosystems has resulted in reduced habitat availability, quantity and utilization for wildlife species dependent on open ponderosa pine habitat.

Agricultural Development

Agricultural development has altered or destroyed most of the native interior grassland habitat in the lowlands. Agriculture in the ecoregion includes dry land wheat farms, irrigated agricultural row crop production and irrigated agriculture associated with livestock production (alfalfa and hay). Many wetlands have been drained for agriculture; currently, most of the region's remaining wetlands are found at higher elevations. These seasonal wet meadows provide important habitat for migrating and breeding birds. Almost all of the largest remaining blocks of these wetlands are located on private lands.

Grazing Practices

Livestock grazing (especially sheep) began in the late 1800's and rapidly expanded to a high intensity, where it remained for many decades. This led to a number of important ecological changes. Grazing pressure led to fundamental changes in natural plant community composition – so much in some areas that it allowed for alien species such as cheatgrass to rapidly invade, altering fire disturbance frequency and intensity and causing further damage to native species. There has been some rangeland recovery over recent decades, but many scars still remain. Livestock currently graze much of the remaining interior grassland habitat. Drier steppe habitats were either inter-seeded with or converted to intermediate wheatgrass or crested wheatgrass, further reducing the quality and amount of native habitat.

Invasive Alien Plant and Animal Species

Invasive plant and animal species are introduced in a number of ways, including hitchhiking on horses, boats, cars and trucks, being imported in aquaculture and horticultural products, accidental releases from research institutions and laboratories, and the pet/aquarium trade. Invasive plants displace native vegetation, resulting in the loss of habitat diversity and function. They can severely impact native plant and animal communities, and exotic grasses and shrubs can add significantly to the fire fuel load, resulting in hotter wildfires that increase damage to native vegetation. The number and abundance of introduced species in an ecoregion is an indicator of declining ecosystem health.

The following additional habitat and species conservation problems have been identified in the Blue Mountains ecoregion:

Wildlife species and population problems: includes disease, pathogens, competition, food scarcity, predation, overharvest, limited population size and distribution.

- Populations of gray wolf and American white pelican have declined to the point where they are listed as endangered. Mountain quail populations have declined significantly from historic levels.
- Recovery plans are needed to guide conservation actions for threatened or endangered species, including American white pelican and gray wolf.
- Wolves are expected to recolonize forested parts of Washington, and interagency management response guidelines are needed.
- Small population sizes and loss of genetic diversity may be a concern in species that appear to be reduced to isolated populations, including mountain quail, sagebrush lizard, margined sculpin, winged floater and Oregon floater.
- Management plans are needed for the margined sculpin and peregrine falcon, state sensitive species, to ensure that they do not become threatened or endangered.
- The populations of species that are important prey of golden eagles have declined and may impact productivity of the predator population.
- Killing or persecution is a problem for many species, including: shooting gray wolves and American white pelicans, killing bald eagles for the black market in eagle parts, poisoning ground squirrels, and shooting American badgers.
- Declines of burrowing mammals have reduced availability of burrows for nesting by burrowing owls.
- Isolated populations of Mann's mollusk-eating ground beetle are at risk of extinction.

Lack of biological information in species and habitats:

- There is a shortage of adequate spatial inventory and assessment data on most habitat types.
- Data are needed on the population trends of the American white pelican, bald eagle, and gray wolf as they recolonize former range, and for the state sensitive species, margined sculpin and peregrine falcon.
- There is a lack of information on the status of populations of state candidate species in the ecoregion, including: Townsend's big-eared bat, northern goshawk, golden eagle, flammulated owl, burrowing owl, Vaux's swift, pileated woodpecker, white-headed woodpecker, black-backed woodpecker, Lewis' woodpecker, sagebrush lizard, western toad, Rocky Mountain tailed frog, Columbia spotted frog, leopard dace, river lamprey, mountain sucker, Columbia River tiger beetle, Mann's mollusk-eating ground beetle, Shepard's parnassian, and juniper hairstreak.
- There is insufficient baseline data on the habitat values and functions of natural wetlands, including the status of resident macroinvertebrates.
- There is inadequate spatial inventory and assessment of riparian habitats as well as a lack of survey data on Neotropical migrant birds and other riparian-dependent wildlife.
- Additional information is needed on the current distribution and abundance of Preble's shrew, American badger, pygmy nuthatch, mountain quail, pygmy horned lizard, Pacific lamprey, winged floater, Oregon floater, western ridged mussel, and western pearlshell.
- Data are needed on genetic diversity and gene flow in bull trout populations.

Habitat loss, conversion, fragmentation and degradation:

- Loss, fragmentation and degradation of native grassland habitat are the likely causes of declines in many species, including Townsend's big-eared bat, American badger, golden eagle, prairie falcon, burrowing owl, and pygmy horned lizard.
- Mountain quail habitat has been degraded by overgrazing, herbicides and development.
- Permanent losses of riparian wetland habitats are occurring due to rural residential growth, suburban sprawl, ranchettes, subdivisions, subdivided cropland and floodplain encroachment.
- Grassy and herbaceous balds are rare patch habitats distributed in low and high elevation forests. They often have associated rare species that are vulnerable to certain forest practices and recreation.
- Loss of juniper to development and nectar plant destruction from land management practices affects the juniper hairstreak.
- Closing off abandoned mines excludes Townsend's big-eared bat from roosting and maternity sites.
- Wetland drainage, altered hydrology or succession of wetlands may eliminate habitat of the Columbia spotted frog.

Incompatible land management practices:

- Logging and fire suppression have created overly dense stands at risk of crown fires and have reduced the quantity and degraded the quality of mature ponderosa pine habitat of Lewis' woodpecker, pygmy nuthatch, flammulated owl and other species.
- The loss and degradation of mature forests that provide abundant and reliable seed sources, snags and nest cavities have affected all woodpeckers and secondary cavity nesters, including black-backed woodpecker, pileated woodpecker, Lewis'

woodpecker, white-headed woodpecker, pygmy nuthatch, flammulated owl, great gray owl and Vaux's swift.

- Fire suppression, grazing and selective timber harvesting have degraded open ponderosa pine forests. Cottonwood forests are also in decline.
- Improper grazing, herbicide application and other land management practices have degraded mountain quail habitat and Mann's mollusk-eating ground beetle habitat, and can affect butterflies, including the juniper hairstreak and Shepard's parnassian, by reducing the availability of nectar plants.
- Logging, agriculture, road building, or other activities that elevate temperature may alter hydrology and increased sedimentation may degrade habitat of margined sculpin, inland redband trout, Rocky Mountain tailed frog, Columbia spotted frog, bull trout, mountain sucker, leopard dace, westslope cutthroat, winged floater and Oregon floater.
- Degradation of native grasslands from cheatgrass and invasive weeds, or inappropriate use of grazing or herbicides, affects sagebrush lizard and many other grassland-dependent species.
- Mountain quail habitat has been degraded by past inappropriate use of grazing and herbicides.

Alien and invasive plant and animal species:

- Non-native species pose a threat to native species through competition, hybridization and predation. Examples include invasive plants that have reduced the habitat for Shepard's parnassian butterfly, non-native trout that hybridize and compete with native westslope cutthroat and bull trout, and non-native bullfrogs and/or introduced predatory fish that prey on Columbia spotted frogs.
- Noxious weeds such as yellow starthistle, spotted and diffuse knapweed, rush skeleton weed, leafy spurge and introduced annual grasses are pervasive and have taken over thousands of acres of grassland wildlife habitat within the ecoregion.
- Annual grasses such as cheatgrass, bulbous blue grass, medusahead and others have become naturalized throughout the ecoregion and have either completely displaced or compete heavily with native grasses and forbs in most areas.
- Reed canary grass thrives in reservoirs, wetlands and stream outlets where water levels fluctuate, and directly affects habitats that support 27 Washington state-listed plant species. A number of native fish, amphibians and other wildlife species are not well adapted to spawn or reproduce in reed canary grass thickets.

Human disturbance and recreational impacts:

- Human disturbance is a significant problem at certain nest sites of bald eagle, golden eagle, peregrine falcon and prairie falcon, and at breeding, maternity roosts or hibernacula of Townsend's big-eared bat.
- Offroad recreational vehicle use may damage vegetation, cause erosion, promote invasive plants, and disturb nesting and migrating wildlife.

Environmental contaminants:

- Bald eagles and golden eagles are occasionally poisoned after eating dead or injured waterfowl or other game animals that contain lead shot or bullets.
- Bald eagles, peregrine falcons and prairie falcons concentrate persistent chemicals (DDE, PCBs) that can cause eggshell thinning, making them vulnerable to any persistent toxic chemical.
- Agricultural chemicals potentially impact the Columbia spotted frog.

Incompatible transportation and energy development:

- Some electrocution of raptors still occurs, even though electric transmission towers are being modified.
- Dams cause passage problems for fish, including bull trout, river lamprey and Pacific lamprey, and have inundated free-flowing stream habitat of the Columbia River tiger beetle, winged floater and Oregon floater.
- Western toads may suffer roadkill mortality when moving to and from breeding sites.
- Railroad tracks along the Lower Snake River contribute to direct wildlife mortality, loss and alteration of habitat from fires, and indirect losses of wildlife and habitat from rock riprap along reservoirs.
- Wind energy projects may cause mortality to many species of birds and bats.

Inadequate water quantity and quality:

- Logging, road building, agriculture or other activities that elevate temperature, alter hydrology, water levels or increase sedimentation may degrade habitat for several aquatic species, including the Columbia spotted frog, Rocky Mountain tailed frog, inland redband trout, margined sculpin, Columbia River tiger beetle, winged floater and Oregon floater. The loss of beaver and beaver ponds may be important as well.
- The increasing number of human dwellings adjacent to waterways may impact water quality due to the increased dispersion of nutrient sources.

Inadequate enforcement and/or mitigation:

- Illegal harvest and harassment of migrating and spawning fish species is occurring in many rivers and tributaries.

CONSERVATION ACTIONS

Conserve and recover wildlife species and populations: includes population management, protection of known populations, population augmentation and or reintroduction, control and monitoring mortality, enhancement of food sources/prey.

- Develop recovery plans for the American white pelican and the gray wolf.
- Prepare interagency management response guidelines for wolves to document sightings and address conflicts.
- Implement recovery actions for the bull trout.
- Complete the Washington Bat Conservation Plan.
- Develop management plans for the state sensitive species, peregrine falcon and margined sculpin.
- Conduct translocations of mountain quail into suitable former habitat.
- Assess other species for possible addition to the state candidate list.

Conduct research, assessment and monitoring: includes species and habitat distribution, abundance, limiting factors, suitable habitat and population trends.

- Monitor any colonizing wolves to determine pack establishment and habitat use.
- Monitor population trends of American pelican, gray wolf and bull trout to determine whether recovery objectives are being met.
- Determine the status of candidate species including Preble's shrew, Townsend's big-eared bat, northern goshawk, golden eagle, flammulated owl, burrowing owl, Vaux's swift, white-headed woodpecker, black-backed woodpecker, Lewis' woodpecker, sagebrush lizard, western toad, Rocky Mountain tailed frog, Columbia spotted frog, bull trout, leopard dace, river lamprey mountain sucker, Columbia River tiger beetle, Mann's mollusk-eating ground beetle, Shepard's parnassian and juniper hairstreak.
- Conduct periodic surveys of sensitive species including margined sculpin and peregrine falcon.
- Conduct post-downlisting surveys and monitor peregrine and bald eagle populations for signs of decline that could result from bioaccumulation of contaminants.
- Assess and map important habitats and areas of high biodiversity in the ecoregion using ecoregional assessments, local habitat assessments, Interagency Vegetation Mapping Project, and other habitat inventories and plans. Update ecoregional assessments every five years.
- Develop statewide land cover and threats data layers to improve connectivity between priority conservation areas.
- Identify and assess environmentally sensitive lands and key wildlife connectivity areas and corridors between fragmented habitats and protected areas.
- Improve understanding of the ecological processes of seeps, bogs, wet meadows, forested wetlands, marshes, springs and other wetlands, and how they are impacted by human development.
- Conduct hydrologic studies that include water quantity and chemical budgets at wetlands known to be supporting rare and endangered species. Use this information to inform wetland management.
- Inventory and prioritize riparian habitat types and attributes needing protection and conservation.
- Identify important habitats for restoration and assess the feasibility of successfully restoring these sites. Include an evaluation of current and projected land use in and adjacent to potential restoration sites.

- Develop effective survey techniques and determine the abundance and distribution of American badger, pygmy nuthatch, pygmy horned lizard, winged floater, Oregon floater, western ridged mussel, western pearlshell and Pacific lamprey.
- Identify essential habitat, limiting factors and dispersal for mountain quail.
- Research habitat needs, limiting factors, environmental stressors, predation and trophic relationships for lamprey; develop methods to differentiate between species of lamprey.
- Refine and verify element occurrences and distribution data for rare communities such as native grasslands, modeled riparian communities and neotropical birds.
- Investigate the genetic diversity and gene flow in bull trout populations.

Protect, restore and connect habitats:

- Use ecoregional assessments and other biological assessments to prioritize conservation areas. Protect important habitat types, biodiversity areas, and environmentally sensitive lands that should not be altered through a variety of techniques including acquisitions, conservation easements, life estates and cooperative agreements with willing landowners.
- Coordinate with local land trusts, conservation districts and other conservation organizations and agencies to conserve important habitat on both public and private land. Focus limited resources in regionally significant areas. Identify all possible acquisition and restoration grants and coordinate applications.
- Work with the Forest Service and other public landowners to protect existing roadless areas and expand the roadless area network where justified for habitat protection and connectivity.
- Protect rare habitat types such as grassy and herbaceous balds, juniper savannahs, aspen stands, snag patches, caves, cliffs and talus.
- Protect key connectivity areas and wildlife corridors between fragmented habitats and between protected areas through a variety of techniques including acquisitions, conservation easements, life estates and cooperative agreements with willing landowners. Use statewide land cover and threats data layers to improve connectivity between priority conservation areas.
- Restore native habitats, habitat connectivity and wildlife corridors where appropriate on both public and private lands. Consider restoring lands adjacent to existing protected areas to increase their effective size and function as wildlife habitat.
- Purchase water rights from willing sellers in unregulated tributaries; use these water rights to restore and maintain adequate year-round flows for both instream and out-of-stream riparian fish and wildlife habitat.
- Rehabilitate and restore stream channels, floodplain functions, riparian habitat and connectivity where streams have been diverted, fragmented or degraded. Use livestock exclusions, instream structures, bank modifications and other methods.
- Preserve and/or restore buffer areas in appropriate locations along tributaries and mainstem waterways to a condition that is adequate to maintain healthy, functioning riparian zones for the ecoregion's rivers.
- Consider protection and restoration of lands adjacent to existing protected areas to increase their effective size and function as wildlife habitat.
- Identify and protect essential habitat for candidate species including Preble's shrew, Townsend's big-eared bat, northern goshawk, golden eagle, flammulated owl, burrowing owl, Vaux's swift, white-headed woodpecker, black-backed woodpecker, Lewis' woodpecker, sagebrush lizard, western toad, Rocky Mountain tailed frog, Columbia spotted frog, leopard dace, river lamprey, mountain sucker, Columbia River tiger beetle, Mann's mollusk-eating ground beetle, Shepard's parnassian, and

juniper hairstreak through livestock fencing, management agreements, easements, acquisitions and livestock fencing.
- Protect nesting sites, large snags and forest stand age and structure as needed for great gray owl, Vaux's swift, pileated woodpecker and northern goshawk.
- Maintain mature and old growth ponderosa pine and restore degraded pine forests by thinning dense understory fir and returning to natural fire regimes for white-headed woodpecker, Lewis' woodpecker and pygmy nuthatch.
- Continue to require bald eagle habitat plans that include retention of trees.
- Identify and restore habitat for mountain quail.

Improve land management practices:

General

- Allow natural disturbances and successional functions and processes to occur on conserved wetlands.
- Manage undeveloped publicly-owned land for conservation of priority habitats and species.

Fire management

- Work with public agencies and private landowners to reduce the potential destructive impact of wildfires on native habitats by incorporating measures such as fire breaks and prescribed burning into wildlife and land management plans.
- Work with the Washington Forest Practices Board and both public and private forest landowners to properly design and implement current forest practices rules, including the Forests and Fish Agreement to protect fish, wildlife and habitat.
- Coordinate with public land managers on the use of controlled fire regimens and stand management practices. Attempt to simulate natural disturbance regimes and restore proper ecological functions. Consider impacts to local wildlife in each burn plan, including timing, size and location of the burn.

Forest practices

- Protect existing old growth, nesting sites, large snags and mature forest stand age and structure needed for northern goshawk, great gray owl, ***flammulated owl***, Vaux's swift, pileated woodpecker, white-headed woodpecker, Lewis' woodpecker, black-backed woodpecker and pygmy nuthatch.
- Maintain mature and old growth ponderosa pine and restore degraded pine forests by thinning dense understory fir for white-headed woodpecker, Lewis' woodpecker, flammulated owl and pygmy nuthatch.
- Maintain stream buffers during timber harvest and conduct proper land use management to protect bull trout, margined sculpin, mountain sucker, inland redband trout and leopard dace.
- Maintain and enforce Forest Practices rules protecting bald eagle roost sites and nests.

- Protect remaining old growth conifer and hardwood stands to benefit late successional species and manage some stands on long rotations (>200 years).
- Work with the Department of Natural Resources and the State Forest Practices Board to develop, implement and enforce forest practices regulations to enhance biological diversity on existing state and private managed and protected areas.
- Work through the State Forest Practices Board and directly with forest landowners to implement forest management prescriptions, including prescribed burns, which will maintain and enhance biodiversity and natural ecosystem functions. Encourage modified silvicultural prescriptions that promote local topographic, soil and vegetative conditions.
- Encourage the development of selective harvest policies and guidelines on both public and private forest land that will leave adequate components of old growth habitat such as snags and downed wood and some live trees as habitat for associated wildlife.
- Work with land managers and landowners to implement forest practices that benefit mountain quail and Lewis' woodpecker.
- Minimize logging roads and decommission them after the period of entry. Ensure that all logging and forest access roads are located in stable, non-erodible areas and outside riparian management zones.
- Ensure the integrity of riparian habitat by maintaining adequate riparian management zones along streams in all logging sites, on both public and private land.
- Encourage public and private forest landowners to manage forested watersheds that maintain an appropriate mix of successional stages and provide connectivity of riparian and upland vegetation as protected travel corridors for wildlife.
- Conduct land use management of riparian areas to conserve western toad, ***Rocky Mountain tailed frog,*** Columbia spotted frog, margined sculpin, mountain sucker, inland redband trout and bivalves.

Grazing and agricultural practices

- Work with public, tribal and management agencies to fence or otherwise protect riparian zones from livestock grazing and unauthorized offroad vehicle use. Consider retirement rather than renewal of grazing leases on sensitive lands.
- Work with conservation districts, Natural Resource Conservation Service, USDA Forest Service and private landowners to implement best management practices in riparian areas and associated upland habitat in conjunction with the Conservation Reserve Program, Wetland Reserve Program and other Farm Bill Programs.
- Use the Comprehensive Resource Management Plan process for large landscapes with a mix of public and private landowners to modify grazing regimes and improve grassland understory conditions and enhance biodiversity.
- Assist private landowners in securing funding to fence riparian zones on private land. In areas where it is impractical to exclude livestock, protect habitat quality by controlling the timing and intensity of livestock grazing through regulation and landowner agreements.

- Work with private and public landowners to minimize the impacts on habitat and wildlife from modern agriculture, including agrochemical use, water use and soil erosion.
- Prevent grazing and forest practices where they are incompatible with mountain quail habitat.
- Ensure that grazing leases on state lands comply with HB1309 “Ecosystem Management Standards” to maintain fish and wildlife habitat.

Control and prevent introduction of alien and invasive species:

- Develop a regional plan for the detection, rapid response and eradication of invasive species.
- Work with other public agencies and private agricultural organizations such as the Farm Bureau and Washington Grange to develop basic techniques for mapping and monitoring the spread of invasive plant species over time.
- Participate in federal and state agency partnerships to develop and implement weed control strategies for impacted sites and ecosystems.
- Develop educational and public information materials to increase public awareness of the ways that invasive exotic species are introduced to sensitive ecosystems.
- Provide funding, incentives and technical assistance to private landowners to eliminate undesirable invasive plant species in riparian zones and to restore native plants that provide important habitat for native fish and wildlife. Use integrated pest management practices to control currently established invasive species with help from volunteers.
- Avoid introduction of non-native fish in fishless lakes and where species of conservation concern occur such as bull trout, westslope cutthroat trout, native amphibians and reptiles. Avoid introduction of rainbow trout or only introduce sterile fish where westslope cutthroat are found. Avoid introduction of non-native trout to protect bull trout from hybridization, competition and predation.
- Control bullfrogs and predatory fish as needed in Columbia spotted frog habitat.
- Prevent introductions of exotic competitors in winged floater and Oregon floater habitat.
- Control infestations of knapweed, rush skeleton weed and other weeds to prevent degradation of grassland habitats.

Control and monitor disturbance:

- Eliminate vehicular access and campsites in conservation areas identified as sensitive habitats, such as montane wetlands, bogs, prairies and dunes.
- In sensitive habitats, manage both land and water access by using fencing, trails, elevated boardwalks, railings, seasonal restrictions, signage and livestock restrictions.
- Reduce the amount and impact of unauthorized recreational access and use on important wildlife habitat through better enforcement of existing laws, more fencing and posting of critical habitat areas, selective road closures and increased public education and information for recreational users and user groups.
- Protect Townsend’s big-eared bats and nesting golden eagles, bald eagles, peregrine falcons and prairie falcons through use and access restrictions on public lands as needed, and work with private landowners and permitting agencies to prevent blasting or construction disturbance during nesting. Inform rock climbers of sensitive periods and locations to reduce disturbance of nesting peregrines, golden eagles and prairie falcons.
- Limit access to roost and hibernacula sites for Townsend’s big-eared bat.

Control and prevent environmental contamination:

- Work with governmental and nonprofit agencies to develop an ecoregion-wide strategy for identified toxins and other pollutants: their sources, destinations and effects, and ways to reduce their discharge.
- Work with other agencies, industry and private landowners to encourage use of integrated pest management techniques and phase out the use of pesticides and herbicides.
- Clean up contaminated sites and sediments wherever possible and prevent further toxic contamination of areas, including unconfined spoil disposal sites.
- Reduce the use of hazardous chemicals by continuing to implement the persistent bioaccumulative toxins strategy and by using a variety of best management practices and improved treatment methods.
- Facilitate use of nontoxic alternatives to lead shot and lead fishing sinkers.
- Work with other agencies to reduce and remediate sources of contaminants that contribute to prey contamination for bald eagles, peregrine falcons, etc.

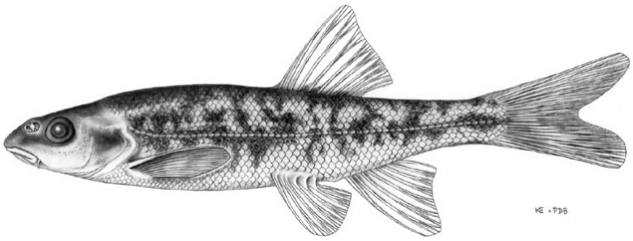
Improve transportation and energy development:

- Work with the Washington Department of Transportation to locate highways way from important wildlife habitats and biodiversity areas. If impacts are unavoidable, design adequate mitigation such as underpasses, overpasses and fencing to accommodate wildlife that need passage, e.g. near western toad breeding sites.
- Reduce mortalities of bald and golden eagles through modification of electric transmission and distribution lines where needed.
- Work with land management agencies, utility licensing agencies and telecommunications and energy companies to ensure that the placement of new windpower or cell towers does not negatively affect resident wildlife species, migrating birds or bats.

Improve water quantity and quality:

- Manage wetland areas on public land for both high water quality and habitat value. Ensure that the water quality of inflow does not lead to deterioration of the wetland habitat.
- Where possible, restore or rehabilitate the hydrology, water quality and native plant communities in degraded and disturbed wetlands. Methods should emphasize creating or restoring natural wetland functions e.g. conserve beaver populations and dynamic stream processes to benefit species like the Columbia spotted frog.
- Manage runoff from highways according to the updated highway runoff manual. Improve the road drainage network in riparian zones by removing unnecessary culverts, increasing the size of inadequate culverts or replacing culverts with bridges.
- Reduce the harm from stormwater runoff by working to improve the effectiveness of the National Pollutant Discharge Elimination System stormwater permit programs.
- Assist local jurisdictions in finding solutions to increase landowner compliance with onsite sewage system maintenance and animal waste management practices through education and regulated inspection. Work to reduce the number and volume of combined sewer overflow events.

- Reduce sedimentation and pollution to conserve aquatic species of concern such as bull trout, margined sculpin, mountain sucker, ***leopard dace***, westslope cutthroat, inland redband trout, river lamprey Pacific lamprey, winged floater, Oregon floater, western ridged mussel and western pearlshell.



Improve coordination, planning, permitting and mitigation:

- Provide credible scientific information on priority habitats and species and biodiversity areas, their significance, management needs and compatible land uses to decision-makers at site, local and regional scales.
- Provide technical assistance to counties in using fish and wildlife and biodiversity information to update comprehensive land use plans, community or watershed plans, Shoreline Master Plan, etc.
- Assist counties in developing and updating county ordinances and incentives that help to mitigate or control development in areas with resource and conservation values and that encourage environmentally sensitive development in growth areas.
- Work with local governments and conservation organizations to identify and protect areas of important habitat and biodiversity through existing environmental laws and other local programs.
- Encourage floodplain management and shoreline zoning protection programs.
- Develop a coordinated conservation vision and strategy for conservation of large landscapes using a structured process like The Nature Conservancy's 5-S Project Management System or the Cascade Dialogs.
- Review state and federal land management plans to ensure adequate protection for priority habitats and species, biological diversity and ecosystem health.
- Develop site management plans for protected areas.
- Work with public and tribal land management agencies to protect important habitat and areas of high biodiversity from loss and fragmentation as well as degradation.
- Coordinate and integrate species recovery and management plans with land management and watershed plans using regulatory and voluntary approaches.
- Participate in Growth Management Act, shoreline Management Act, Forest Protection Act and Federal Energy Regulatory Commission permitting processes for new or expanded residential, recreational or hydropower development on private land.
- Use information from ecoregional assessments to illustrate important habitats and areas of high biodiversity. Encourage permitting agencies to designate and protect these areas from residential and recreational development, and to require mitigation for habitat conversion and fragmentation where it occurs.
- Work closely with the USDA Forest Service and other land management agencies to prevent or mitigate potential adverse impacts to fish and wildlife habitat fro proposed recreational or hydropower development on public lands.
- Work with regulatory agencies to design effective mitigation strategies for projects that result in wildlife impacts or direct conversion or fragmentation of habitat.
- Assist federal agencies in implementing the Interior Columbia Basin Ecosystem Management Strategy.
- Represent WDFW's conservation interests on interagency recovery teams and working groups.

Improve enforcement of laws and regulations:

- Enforce laws, investigate and prosecute illegal killings of bald eagles, American white pelicans, wolves, bull trout and other endangered wildlife.
- Enforce restriction on transplantation of fishes, non-native turtles, bullfrogs, etc. to protect Columbia spotted frogs and margined sculpin.
- Enforce recreational access restrictions on public lands and aquatic areas.

Improve landowner assistance:

- Work with large and small timber companies and landowners to accomplish habitat conservation through nonregulatory approaches such as landowner incentives, conservation easements, habitat conservation plans and acquisition of critical habitat from willing landowners.
- Secure state and federal tax incentives that discourage habitat fragmentation and destruction and that encourage landowners to protect and manage their land to benefit wildlife habitat.
- Work with local government to implement the Public Benefit Rating System and encourage effective use of open space tax incentives for landowners.
- Work with private landowners to identify and protect areas with important habitats and biodiversity and protect these areas through landowner incentives and other nonregulatory programs. For example, work with landowners to restore native vegetation and conserve local populations of burrowing mammals.
- Provide educational materials to private landowners that describe management techniques for maintaining and restoring various wildlife habitats.
- Work with private landowners to identify and protect important wetland habitats and buffers by providing adequate water, controlling invasive plants, reducing disturbance to nesting wildlife and fencing or otherwise keeping livestock out of wetlands and associated upland habitat.
- Influence the application of federal Farm Bill funds, including the Conservation Reserve Program and the WDFW Landowner Incentive Program, on private agricultural lands most critical for wildlife movement and most suitable for restoration of native wetlands and grassland habitat.
- Promote grant programs to assist landowners with implementation of management plans.
- Develop, periodically update and provide WDFW Priority Habitats and Species management recommendations to assist landowners in conserving priority habitats and species.

Improve wildlife conservation education: includes outreach, volunteer and watchable wildlife programs.

- Engage and involve local and tribal governments, state and federal agencies, organizations and citizens in efforts to protect and restore priority habitats and species through a variety of outreach projects, programs and education efforts.
- Increase the use of citizen science for the collection of data, monitoring, restoration and conservation of important habitats and associated wildlife species. Coordinate volunteer monitoring and involvement.
- Promote and maintain public information and education efforts that focus on endangered species, habitat loss, ecological function, biological diversity and environmentally-aware lifestyle practices. Emphasize the connection between habitat and environmental quality and human health and welfare.

- Expand conservation education programs for both adults and children to emphasize the critical nature and vulnerability of sensitive habitats such as wetlands, oak and grassland habitats and associated wildlife.
- Connect with user groups through education to make them part of the conservation solution in areas that have high recreation values.
- Work with large corporations to increase awareness and develop financial support for conservation of biodiversity.
- Within the Blue Mountains ecoregion, conduct education and outreach programs to help recovery of American white pelicans, wolves, and other endangered wildlife; prevent introductions of exotic competitors of winged and Oregon floater; discourage control of ground squirrels and other mammalian prey of gold eagles and prairie falcons; and discourage killing of American badgers and other burrowing mammals that provide burrows for burrowing owl nests.

Prairie falcon.

COLUMBIA PLATEAU ECOREGION

PHYSIOGRAPHY AND FISH AND WILDLIFE DIVERSITY

Geography

The Columbia Plateau ecoregion includes the area in eastern Washington bounded by the Cascade, Okanogan, Blue and Rocky Mountains. Approximately one-third of Washington is within this ecoregion. More than 50 percent of the ecoregion in Washington has been converted to agriculture or development. Agriculture consists of a mixture of dryland and irrigated farming. Urban development in this ecoregion is mostly associated with rivers and lakes.

Geology

The Columbia Plateau ecoregion rests primarily on Columbia River basalt. Windblown silts and volcanic ash cover extensive areas, creating rolling, deep, productive soils. Ice-age floods carved deep canyons and coulees through the basalt. The floods also scoured some areas of soils and vegetation, leaving the basalt exposed on the surface. The ecoregion's dominant landforms include the Palouse Hills, Channeled Scablands, Yakima Fold Hills, and Pasco Basin. Elevations range from 160 feet above sea level along the Columbia River in the southwestern corner to nearly 4,000 feet above sea level on isolated hills in the Badger and Tekoa mountains.

Climate

The Columbia Plateau has the hottest and driest climate in the state. It lies in the rain shadow of the Cascade Mountains. Annual precipitation generally ranges from around 6 inches per year along the Hanford Reach of the Columbia River to 25 inches in the Palouse Hills. Most of the ecoregion receives 8 to 14 inches of precipitation. Periodic drought and natural fires are common environmental features of this ecoregion.

Habitat and Plant Associations

The ecoregion is most often characterized as shrub-steppe, dominated by various species of drought-tolerant shrubs, forbs and grasses. Much of the remaining native vegetation occurs on steep canyon sides and on the shallower soils of basalt scablands. Bitterbrush and three-tip sagebrush steppe appear along the foothills of the Cascades. Douglas-

fir/ponderosa pine forests occur on moister sites near the foothills of the surrounding mountains. Special habitat elements include sand dunes, gravelly areas, basalt cliffs, steep canyons, alkali lakes and vernal pools. Although predominantly a sagebrush shrubland, this ecoregion contains other steppe plant communities such as salt desert shrub, desert playa and native grasslands.

There are 46 plant community alliances and approximately 450 plant community associations found in the Columbia Plateau ecoregion. More than 20% (105) of these plant community associations are considered vulnerable by the Washington Natural Heritage Program. Riparian and aquatic natural communities, along with associated species, are only now beginning to be classified. They represent another aspect of biological diversity that is yet to be fully documented.

Fish and Wildlife Diversity

Despite extensive habitat conversion due to agriculture and other factors, the Columbia Plateau ecoregion still has a few large expanses of wildlands and areas of high biodiversity. Land set aside and managed by the Departments of Defense and Energy (Yakima Training Center and Hanford Reservation) provides some of the best examples of remaining shrub-steppe habitat in Washington.

At least 239 plant and animal species, including approximately 72 endemic (occurring only in a specific locale) plant species, are found in the Washington portion of the Columbia Plateau ecoregion. Vulnerable species occur in all habitats and sections of the ecoregion, but they are not distributed equally across it. There are concentrations of endemic species in unique habitats and there are concentrations of vulnerable species found in habitats that have been significantly altered by human activities. Numerous species of birds of prey nest here at high densities. Invertebrates are among the most threatened species and many species are just beginning to be classified taxonomically. The Columbia River, which bisects the ecoregion and forms a portion of the border between Oregon and Washington, once sustained one of the largest salmon runs in the world and is an important component of the biodiversity of this semi-arid landscape.

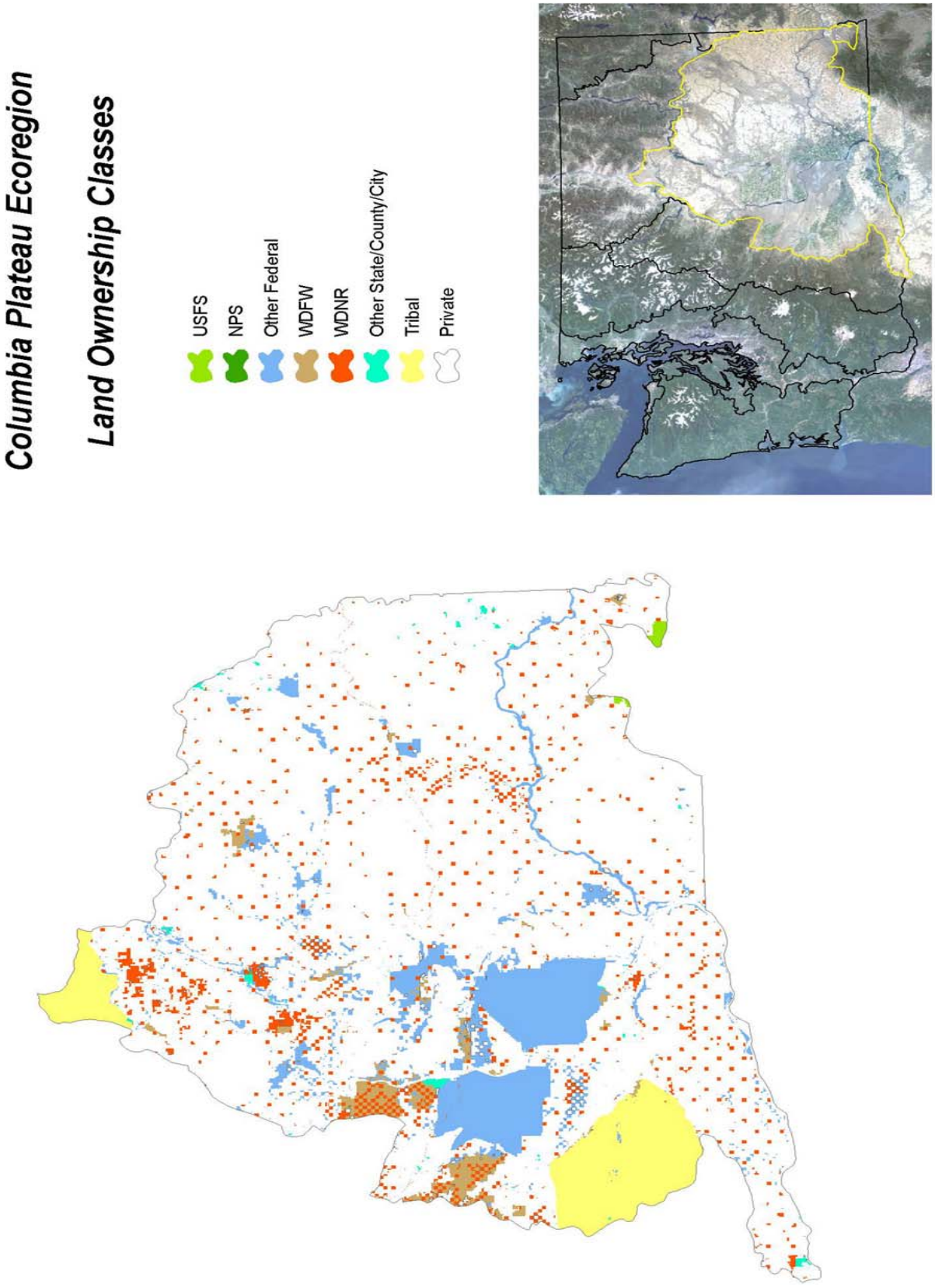
LAND OWNERSHIP AND POPULATION

The federal government owns about 10% of the Columbia Plateau ecoregion, in particular the Bureau of Reclamation and Bureau of Land Management. The Hanford Reservation in Benton County, owned by the Department of Energy, as well as the U.S. Army's Yakima Training Center in Yakima County, are critical strongholds of biodiversity in the ecoregion. The Hanford Reservation in particular contains some of the highest quality and most significant examples of sagebrush steppe ecosystems in Washington; much of the Hanford Reservation is now managed by the U.S. Fish and Wildlife Service. Nearly 865,000 acres of the Columbia Plateau are owned by Washington state agencies. The Washington Department of Fish and Wildlife manages about 241,000 acres in the ecoregion, including the Desert, Swanson Lakes, Sunnyside, and Esquatzel Coulee Wildlife Areas.

A number of other ecologically important sites are managed by the U.S. Fish & Wildlife service, including the Columbia, McNary, Saddle Mountain, Toppenish, Mid-Columbia River and Turnbull National Wildlife Refuges. Nearly half the ecoregion is in private ownership but its distribution differs considerably from public lands. Valley bottomlands, stream drainages and the arable lands are all largely in private ownership. Land conversion, mostly to foster intensive agriculture, has occurred to a considerable extent on private lands in the ecoregion.

The Columbia Plateau's economic base is firmly rooted in agriculture and commodity extraction-related businesses and industry, although there are strong indications that extractive sectors of the regional economy are declining in response to food imports under the North American Free Trade Agreement (NAFTA). Irrigated agriculture is still the most significant economic activity in the ecoregion, with crops ranging from potatoes and peas to wheat and alfalfa. As consumer demand increases and irrigation water is made available, fruit orchards and wineries are also proliferating in the region. Ranching is also an important activity throughout much of the rest of the ecoregion. In Washington, industrial development and population growth is expanding in the Tri Cities (Richland, Pasco, and Kennewick), Yakima, Wenatchee and Spokane areas, with the rest of the ecoregion retaining its rural character. The combined population of the ecoregion is about 900,000 as of 2003. Figure 34 maps the land ownership classes in the Columbia Plateau ecoregion.

Figure 34.


Columbia Plateau Ecoregion
Land Ownership Classes
USFS
NPS
Other Federal
WDFW
WDNR
Other State/County/City
Tribal
Private

ECOREGIONAL CONSERVATION PARTNERSHIPS

Effective conservation of fish, wildlife and biodiversity in Washington requires close coordination and cooperation with many public and private conservation partners. Major partners in the Columbia Plateau ecoregion include:

- U.S. Army (Yakima Training Center)
- U.S. Bureau of Land Management
- U.S. Bureau of Reclamation
- U.S. Department of Energy (Hanford Reservation)
- U.S. Fish and Wildlife Service (six National Wildlife Refuges)
- Washington Department of Natural Resources (WDNR)
- Washington State Parks and Recreation Commission
- Yakama Indian Nation
- Yakima, Grant, Benton, Klickitat, Douglas, Lincoln, Spokane, Adams, Franklin, Walla Walla, Columbia, Garfield, Asotin, and Whitman Counties.

The Washington Department of Fish and Wildlife also works closely on conservation projects with private conservation partners such as The Nature Conservancy, Trust for Public Land, Audubon Washington, Ducks Unlimited, Washington Waterfowl Association, Intermountain West Joint Venture and a growing number of fisheries enhancement groups and local land trusts.

Major Plans and Assessments

A number of ongoing or completed planning efforts involving WDFW and its public and private partners guide the conservation and management of fish and wildlife resources statewide and in the Columbia Plateau ecoregion. Important planning efforts affecting conservation in the Columbia Plateau ecoregion include:

- Columbia Plateau Ecoregional Assessment
- Interior Columbia Basin Management Project
- Intermountain West Joint Venture Coordinated Bird Conservation Plan (2005)
- U.S. Army Yakima Training Center Cultural and Natural Resource Management Plan (2002)
- USFWS Draft Bull Trout Columbia River DPS Recovery Plan (2002)
- WDFW Bald Eagle Status Report (2001)
- WDFW Bull Trout and Dolly Varden Management Plan (2000)
- WDFW Draft Columbia Plateau Regional Wildlife Area Management Plan
- WDFW Ferruginous Hawk Recovery Plan (1996)
- WDFW Game Management Plan (2003)
- WDFW Greater Sage-Grouse Recovery Plan (2004)
- WDFW Margined Sculpin Status Report (1998)
- WDFW Outline for Salmon Recovery Plans (2003)
- WDFW Peregrine Falcon Status Report (2002)
- WDFW Pygmy Rabbit Recovery Plan and Amendments (1995,2001, 2003)
- WDFW Sandhill Crane Recovery Plan (2002)
- WDFW Upland Sandpiper Recovery Plan (1995)
- Yakima, Crab Creek, Palouse, Columbia Lower and Upper Middle, Walla Walla, and Snake Lower Subbasin Plans (2004)

Supporting references to these and other important statewide planning documents are included at the end of this chapter and/or in Appendices 6 and 7.

SPECIES AND HABITATS OF GREATEST CONSERVATION NEED

This section provides a short summary of priority species and associated habitats for the Washington portion of the Columbia Plateau ecoregion.

Species of Greatest Conservation Need

The following species list for the Columbia Plateau ecoregion is a regional subset of the statewide Species of Greatest Conservation Need (SGCN) list shown in Appendices 1 and 2. The process and criteria used to develop the statewide SGCN list are provided in Volume Two: Approach and Methods, as well as in Appendix 3. Species listed below are found in the Columbia Plateau ecoregion for all or part of their lifecycle. Supporting tables and information for these species and habitats can be found in Chapter IV and in Appendices 1, 2, 8, 9, 10 and 14.

	Population Size/Status						Population Trend					
COMMON NAME	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown	State Status*	WNHP
Mammals												
Merriam's shrew			x							x	C	S3
Pallid Townsend's big-eared bat			x							x	C	S3
White-tailed jackrabbit			x				x				C	S2
Black-tailed jackrabbit			x				x				C	S2
Pygmy rabbit	?	x					x				E	S1
Townsend's ground squirrel ssp.			x				x				C	S3
Townsend's ground squirrel ssp.			x							x	N	S2
Washington ground squirrel			x				x				C	S2
Western gray squirrel			x				x				T	S2
Kincaid meadow vole			x							x	M	S2
American badger			x				x				G	S4
Pronghorn antelope	x							x			G	SH
Birds												
Common loon			x					x			S	S2
Western grebe			x				x				C	S3
American white pelican			x						x		E	S1
Trumpeter swan			x						x		G	S3
Redhead			x					x			G	S3
Greater scaup				x							G	S5
Lesser scaup				x			x				G	S4
Bald eagle				x					x		T	S4

COMMON NAME	Population Size/Status						Population Trend				State Status*	WNHP
	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown		
Northern goshawk			x							x	C	S3
Ferruginous hawk			x				x				T	S2
Golden eagle			x							x	C	S3
Peregrine falcon			x						x		S	S2
Prairie falcon			x							x	M	S3
Greater sage-grouse			x					x			T	S1
Sharp-tailed grouse			x				x				T	S2
Sandhill crane (greater)		x							x		E	S1
Upland sandpiper	?	x								x	E	SH
Marbled godwit			x							x	N	S3
Flammulated owl			x							x	C	S3
Burrowing owl			x				x				C	S2
Vaux's swift			x				x				C	S3
Lewis' woodpecker			x				x				C	S3
White-headed woodpecker			x				x				C	S2
Pileated woodpecker				x						x	C	S4
Sage thrasher			x				x				C	S3
Loggerhead shrike			x				x				C	S3
Sage sparrow			x				x				C	S3
Reptiles												
Pygmy horned lizard				x						x	N	S3
Sagebrush lizard			x				x				C	S2
Sharptail snake			x							x	C	S2
Striped whipsnake			x							x	C	S1
Amphibians												
Tiger salamander				x						x	M	S3
Western toad				x			x				C	S3
Northern leopard frog			x				x				E	S1
Columbia spotted frog			x							x	C	S4
Fish												
River lamprey						x				x	C	S2
Pacific lamprey						x				x	N	S3
Margined sculpin				x						x	S	S1
Westslope cutthroat				x				x			G	G4

COMMON NAME	Population Size/Status						Population Trend				State Status*	WNHP
	Extirpated	Critical	Low	Medium	Abundant	Unknown	Declining	Stable	Increasing	Unknown		
Yakima steelhead											G	G5
Mid-Columbia steelhead											C	G5
Snake River steelhead											G	G5
Inland redband trout						x				x	G	G5
Bull trout						x				x	C	G3
Mid-Columbia coho											G	G4
Leopard dace						x				x	C	S2
Mountain sucker						x				x	C	S2
Invertebrates												
Columbia River tiger beetle	?									x	C	S1
Mann's mollusk-eating ground beetle			x				x				C	
Yuma skipper (butterfly)		x								x	C	S1
Shepard's parnassian (butterfly)			x							x	C	S1
Juniper hairstreak (butterfly)						x				x	C	S2
Silver-bordered fritillary (butterfly)			x							x	C	S3
White-belted ringtail (dragonfly)		x								x	N	S1
Columbia (Lynn's) clubtail (dragonfly)			x							x	N	S1
California floater (bivalve)			x				x				C	S1
Western floater (bivalve)			x				x				N	S4
Winged floater (bivalve)			x				x				N	G3
Oregon floater (bivalve)			x				x				N	S3
Western ridged mussel (bivalve)			x				x				N	S2
Western pearlshell (bivalve)				x			x				N	S4
Columbia oregonian (snail)			x				x				N	G2

* Status Codes	** WNHP Codes (S = state, G = global)
E = endangered	1 = critically imperiled
T = threatened	2 = imperiled
S = sensitive	3 = vulnerable to extirpation or extinction
C = candidate	4 = apparently secure
M = monitor	5 = demonstrably widespread, abundant and secure

Species Conservation in the Columbia Plateau Ecoregion

Species of Greatest Conservation Need (SGCN) found in the Columbia Plateau ecoregion (see table above) include those classified by WDFW as Endangered, Threatened, Candidate or Monitor species, as well as species identified by WDFW as needing additional research or funding attention. A range of conservation actions is recommended for these SGCN species at both the statewide and ecoregional levels. These recommended conservation actions are summarized in a series of matrices included in Chapter IV and as Appendices 9 and 10. These matrices also display the life history, population status and distribution of these species.

Ecoregional Habitat Overview

Figure 35 maps wildlife habitat classes in the Columbia Plateau ecoregion.

The following major habitat types classified, coded and described in Wildlife and Habitat Relationships in Oregon and Washington (WHROW), are present in the Columbia Plateau ecoregion. In the next section, descriptions are provided for priority habitats associated with Species of Greatest Conservation Need found in this ecoregion.

- Eastside (Interior) Mixed Conifer Forest
- Ponderosa Pine Forest and Woodlands
- Eastside (Interior) Canyon Shrublands
- Eastside (Interior) Grasslands
- Shrub-steppe
- Dwarf Shrub-steppe
- Desert Playa and Salt Scrub Shrublands
- Agriculture, Pasture and Mixed Environments
- Urban and Mixed Environs
- Open Water: Lakes, Rivers, Streams
- Herbaceous Wetlands
- Eastside (Interior) Riparian-Wetlands

Figure 35.

Columbia Plateau Ecoregion
Wildlife Habitat Classes
Westside Lowland Conifer/Hardwood
Westside Oak/Dry Douglas-Fir
Montane Mixed Conifer
Eastside Mixed Conifer
Lodgepole/Ponderosa Pine/Eastside Oak
Subalpine/Alpine Environs
Grasslands/Shrublands
Agriculture
Urban
Lakes/Rivers/Reservoirs
Wetlands
Coastal Land Environs
Bays/Estuaries

Priority Habitats in the Columbia Plateau Ecoregion

The following four habitat types have been identified as the highest priority for current conservation action in the Columbia Plateau ecoregion. Selection of these habitats as a priority was determined by their importance to regional Species of Greatest Conservation Need, as well as priorities outlined in the Columbia Plateau Ecoregional Assessment and the subbasin plans listed in the "Major Plans" section above. More discussion on the selection of priority habitats is included in Chapter III: Statewide Overview and in Volume Two: Approach and Methods.

- Shrub-steppe/Interior Grasslands
- Herbaceous Wetlands
- Eastside (Interior) Riparian-Wetlands
- Open Water (Lakes, Rivers, Streams)

Shrub-Steppe / Interior Grasslands

Shrub-steppe is the dominant native habitat in the Columbia Plateau. Sagebrush communities are the most widespread component of shrub-steppe habitat, occurring along stream channels, in valley bottoms and in the arid mountains up to and above the treeline. Bitterbrush shrub-steppe habitat is also an important component of shrub-steppe habitat, appearing primarily along the eastern slope of the Cascades, across north-central Washington to the Columbia Plateau.

Shrub-steppe communities support a wide diversity of wildlife. Sagebrush itself is a critical food source for many animals including the endangered pygmy rabbit, threatened sage-grouse, mule deer, and Rocky Mountain elk. Sagebrush provides benefits to the entire ecosystem. It physically protects understory plants, provides vertical structure that adds diversity to the plant community, and provides for snow retention that may benefit the water table. Bitterbrush is also an important food source for mule deer and other wildlife. Soils over much of the Columbia Plateau ecoregion are characterized by the existence of cryptobiotic (or cryptogamic) crusts—a living layer of algae, lichen, and mosses that grow upon or just beneath the soil surface. These crusts help stabilize dry soils with little vegetative cover and prevent wide scale wind and water erosion by regulating water infiltration. With blue-green algae as a common component, these crusts also fix nitrogen benefiting neighboring plants.

Grassland habitat occurs mainly on the plateau landscapes within the ecoregion, such as the Palouse, with a minor amount as canyon grasslands. Native grasslands may grow in a patchwork with shallow soil scablands or within biscuit scablands or mounded topography. Naturally occurring grasslands are not found within the range of bitterbrush and sagebrush species. Grassland habitats exist today in the shrub-steppe landscape where they have been created by brush removal, agricultural impact, or by fire. In general, this habitat is an open and irregular arrangement of grass clumps rather than a continuous sod cover. These medium-tall native grasslands often have scattered and diverse patches of low shrubs. Native grasslands in canyons are dominated by bunchgrasses.

Selected Species Closely Associated with Shrub-steppe / Interior Grasslands in the Columbia Plateau Ecoregion

Burrowing owl	Ferruginous hawk
Prairie falcon	Sage-grouse
Sharp-tailed grouse	Washington ground squirrel
American badger	White-tailed jackrabbit
Black-tailed jackrabbit	Brewer's sparrow
Loggerhead shrike	Pygmy rabbit
Sage sparrow	Sage thrasher
Merriam's shrew	Sagebrush lizard

Herbaceous Wetlands

A variety of wetland types and sizes are distributed throughout the Columbia Plateau ecoregion. Wetlands form primarily where there is a water supply at or near the land surface; the location and persistence of the water supply depends on a number of factors, including precipitation, runoff, evaporation, topography, groundwater discharge, and irrigation which includes surface movement of water. Freshwater marshes are found naturally in the mountains and foothills and also in the plains where the hydrology and soil favor water retention. Wet meadows are found along streams and around mountain lakes and ponds.

Historic wetlands along the Columbia River have been inundated by reservoirs, while the floodplain wetlands along the Yakima River have largely been developed for agriculture. These wetland losses have been partly offset by thousands of acres of herbaceous wetlands created by irrigation runoff from the federally funded Columbia Basin Project. The combination of created wetlands, impoundments of the mainstem Columbia and Snake Rivers, and thousands of acres of grain fields in the Columbia Basin have created attractive habitat for waterfowl and other wetland-dependent migrating birds.

Selected Species Closely Associated with Herbaceous Wetlands in the Columbia Plateau Ecoregion

Kincaid meadow vole	Common loon
Western grebe	Columbia spotted frog
Trumpeter swan	Lesser scaup
Yuma skipper butterfly	Silver-bordered fritillary butterfly

Eastside (Interior) Riparian-Wetlands

Protection of the interior riparian-wetlands habitat type may yield the greatest gains for fish and wildlife, while involving the least amount of area. While riparian habitat covers a relatively small area of the landscape it supports a high diversity and abundance of fish and wildlife. Broad floodplain mosaics consisting of cottonwood gallery forests, shrublands, marshes, side channels and upland grass areas contain diverse wildlife assemblages. Riparian habitat is year-round habitat for many species of wildlife such as beaver. Many

species that dwell primarily in other habitat types such as shrub-steppe depend on riparian areas during key phases of their life history.

Fish and wildlife depend on riparian-wetlands for breeding habitat, seasonal ranges and movement corridors. Important riparian wetland sub-components such as marshes and ponds also provide critical habitat. Riparian-wetlands have other important functions, including water purification, flood control, recreation and aesthetics. The importance of riparian-wetlands habitats is increased when adjacent forest habitats are of sufficient quality and quantity to provide cover for nesting, roosting and foraging. In addition, riparian forests supply large woody debris to river systems and are thus critical to the structure and function of rivers and to the fish and wildlife populations dependent upon them.

Riparian habitat along the mainstem Columbia historically provided a critical link between drainages for many wildlife species such as western gray squirrels, mule deer, and migratory birds. Inundation of these riparian zones has resulted in the extirpation of some species, such as the yellow-billed cuckoo, and population fragmentation of threatened, endangered and sensitive species in watersheds along the Columbia River. Most of these riparian-wetlands have been inundated by hydropower reservoirs.

Selected Species Closely Associated with Eastside (Interior) Riparian-Wetlands in the Columbia Plateau Ecoregion

Pallid Townsend's big-eared bat	Western toad
Tiger salamander	Northern leopard frog
Columbia River tiger beetle	American white pelican
Mann's mollusk-eating ground beetle	

Open Water: Lakes, Rivers, Streams

The major aquatic feature of the Columbia Plateau ecoregion is the Columbia River, which flows north to south and bisects the ecoregion. With the exception of the Hanford Reach, the river has been converted from a free-flowing waterway to a series of reservoirs created by dams constructed for hydroelectric power and irrigation water. Although the hydrology and surface water habitat characteristics of the river have changed dramatically, the Columbia River is still a major migration corridor for Pacific salmon. The reservoirs also provide important resting and feeding areas for waterfowl and other migratory birds.

Major Washington tributaries draining into the Columbia River in this ecoregion include the Snake and Yakima Rivers. Other tributaries include Crab, Glade, Six Prong, Pine and Rock Creeks. Numerous other perennial secondary streams and many intermittent and ephemeral streams contribute water to the Columbia River.

Selected Species Closely Associated with Open Water Habitats in the Columbia Plateau Ecoregion

Leopard dace	Mountain sucker
Green sturgeon	River lamprey
Pacific lamprey	Margined sculpin
Westslope cutthroat	Inland redband trout
Yakima steelhead	Mid-Columbia coho
Mid-Columbia steelhead	White-belted ringtail dragonfly
Western pearlshell	Columbia clubtail dragonfly

CONSERVATION PROBLEMS

The most significant problems in protecting, restoring and enhancing remaining native shrub-steppe in the Columbia Plateau ecoregion are the direct loss and fragmentation of habitat from irrigated agricultural development, dryland wheat and past sagebrush eradication programs, as well as alteration and loss of native habitat diversity and function due to invasive cheatgrass and other alien plant species, improperly managed grazing and alteration of natural fire regimes.

Conversion to Agriculture

More than half of the native shrub-steppe and over 70% of native grassland habitat has been converted to agriculture since the turn of the century, and especially since the inception of the Columbia Basin irrigation project. New water storage projects are currently being promoted that will result in even more irrigated agriculture and more conversion of native habitat to agriculture. Shrub-steppe and interior native grasslands already converted to agricultural crops are difficult to restore to native plant communities, even if left idle for extended periods, because upper soil layers and associated mosses, lichens and microbiotic organisms are often lost to water and wind erosion and tillage practices. Wildlife species associated with shrub-steppe habitat in the Columbia Plateau ecoregion have been reduced in both abundance and distribution as a result of the loss, fragmentation and degradation of native shrub and grassland habitat.

Grazing Practices

Carefully managed grazing can be compatible with good habitat management, but improperly managed grazing on both public and private lands can eliminate native grasses and break down and destroy the microbiotic soil crust that supports native grasses and shrubs. Continued disturbance by improperly managed grazing also allows alien annual plants to invade and replace native plants that are important as wildlife habitat.

Alteration of Natural Fire Regimes

The disruption of the natural fire regime has degraded some of the vegetation communities of the Columbia Plateau ecoregion. Some shrub-steppe communities such as Wyoming big sagebrush types are fire-intolerant. Historically, the natural fire return interval often exceeded 100 years. When wildfires occur, they can eliminate sagebrush for decades and further promote the spread of alien annual grasses, particularly cheatgrass, to the detriment of native plants. Both human-caused fires and the invasion by cheatgrass have increased fire frequency in sagebrush communities, and this has dramatically degraded habitat for sagebrush-dependent species. In these communities, fire poses the biggest immediate threat to wildlife habitat. In other communities such as the Palouse prairies, regular fires historically kept native plant communities in various stages of ecological succession. Fire was important in maintaining these native grasslands by preventing woody vegetation from encroaching and for removing dry vegetation and recycling nutrients. Suppression of natural fires has allowed shrubs and trees to encroach/increase on areas once devoid of woody vegetation.

Many of the most complex resource problems facing the Columbia Plateau ecoregion in the next century revolve around water.

Habitat Loss and Impacts from Hydropower

Much of the rich floodplain alluvial soils adjacent to the Columbia and Snake Rivers are now inundated by hydropower impoundments, and the remaining riparian vegetation in the ecoregion is usually associated with tributaries and mesic (moderately moist) canyon draws. Over 40 percent of reservoir shorelines in the Columbia Plateau ecoregion are riprapped, and the combination of riprap, water fluctuation, shallow soils and steep banks precludes establishment of most new riparian plant communities and associated wildlife populations. However, some emergent wetlands appear to be increasing in size over time in backwater areas of the Columbia River reservoirs, due to sedimentation.

The dependence of many wetlands on local hydrological patterns makes them especially vulnerable to destruction and fragmentation. The total acreage of wetland habitat available for migratory waterfowl and other wetland-dependent wildlife has actually increased in the Columbia Plateau with the expansion of irrigated agriculture. However, the quality and relative abundance of intact native wetland habitat continues to decline with the expanded development of water and wetlands for agriculture and other uses, including recreation.

Riparian habitats are highly vulnerable to disturbance and alteration. Undisturbed riparian systems are rare in the Columbia Plateau ecoregion. Impacts have been greatest at low elevations such as the lower Yakima River watershed. Agricultural development has altered or eliminated vast amounts of native interior wetland habitat in the lowlands, and fragmented much of the remaining riparian/floodplain habitat within the ecoregion. Agricultural operations in riparian zones have also increased sediment loads and introduced herbicides and pesticides into streams. In lower elevations such as the Yakima River watershed, agricultural conversion, altered stream channel morphology and water withdrawal have obliterated or altered the character of streams and associated riparian areas. Losses in lower elevations include large areas once dominated by cottonwoods that contributed considerable structural diversity to riparian habitats. In higher elevations, the overharvest of beaver in the early 1800's began the gradual unraveling of stream function, which was then greatly accelerated with the introduction of livestock grazing. Woody vegetation has been extensively suppressed by improperly managed grazing in some areas, many of which continue to be grazed. Herbaceous vegetation has also been greatly altered with the introduction of Kentucky bluegrass, which has spread to many riparian areas, forming sod at the exclusion of other herbaceous species.

The mainstem Columbia River and Snake River dams present a daunting challenge to the upstream and downstream migration of anadromous fish species. Millions of dollars have been and continue to be spent by public agencies and hydropower users to ensure passage of salmon, sturgeon and lamprey through the dams and to otherwise mitigate for the loss of unimpeded migration corridors and habitat. Unless dams are removed from the mainstem Columbia and Snake Rivers, which is highly unlikely, the most pressing problems for migrating fish will continue to be caused by the dams, including inadequate fish ladders on some mainstem dams, predation within the mainstem reservoirs from walleye and other fish, nitrogen loading and mortality to downstream migrating juveniles from turbines.

The problem of fish passage does not stop with the mainstem Columbia and Snake Rivers, but includes irrigation diversion dams, unscreened culverts, disconnected stream corridors, septic contamination in urbanizing areas, pesticide pollution, sedimentation, thermal loading and low flow conditions on both major and minor tributaries all the way to upstream spawning areas.

Residential Development

Encroaching areas of residential development often occur near wooded riparian areas, lakes or streams. The increasing number of dwellings poses a risk to water quality due to the increased amount and dispersion of potential nutrient sources immediately adjacent to waterways. Residential development in riparian zones also disturbs and displaces wildlife, disrupts migration corridors and encourages the establishment of alien plant and animal species.

Environmental Contaminants

Environmental contaminants from past and current industrial and agricultural activities continue to adversely affect wildlife in the Columbia Plateau ecoregion. Pesticides, herbicides, insecticides, fungicides and rodenticides are widely used to control agricultural pests, and large amounts of fertilizer are used to replace nutrients in depleted soils. Industrial chemicals from aluminum plants and pulp mills and radioactive waste from Hanford nuclear reactors all remain in the environment and water. These contaminants can have both a lethal effect on fish and wildlife and sublethal effects such as impaired reproduction or predator avoidance. Indirect effects include alteration of habitat and reduced food resources. A chemical's capacity to harm wildlife is dependent on several factors, including the characteristics and toxicity, and the timing, duration and dose of exposure.

Recreation

Unauthorized recreational access by offroad vehicles, horses and campers may also have a detrimental effect on Columbia Plateau shrub-steppe, dune and wetland habitats by destroying the microbiotic soil crust, breaking off or uprooting native shrubs and grasses, killing or disturbing wildlife, starting fires, and spreading invasive plants into disturbed areas.

Disease and Pathogens

Usually disease is a normal part of the ecology of most fish and wildlife populations. However, with the reduction and fragmentation of habitat reducing some populations to very low levels, diseases can become a limiting factor. For example, the outbreak of plague in isolated populations of pygmy rabbits and ground squirrels may have a considerable effect as a whole. The occurrence of exotic diseases such as the mosquito-borne West Nile virus may have severe impacts to susceptible species such as sage-grouse. However, widespread environmental treatment of organisms like mosquitoes must be carefully planned and executed to avoid massive mortality of non-target species.

The following additional habitat and species conservation problems have been identified in the Columbia Plateau ecoregion:

Wildlife species and population problems: includes disease, pathogens, competition, food scarcity, predation, overharvest, limited population size and distribution.

- Populations of pygmy rabbit, American white pelican, sage-grouse, sharp-tailed grouse, ferruginous hawk, northern leopard frog, common loon, peregrine falcon and margined sculpin have declined to the point where they are listed as threatened, endangered or state sensitive.
- Small population sizes and loss of genetic diversity is a problem in pygmy rabbits, sage-grouse and sharp-tailed grouse, and may be a concern in several other species that seem to be reduced to isolated populations, including Washington ground squirrel, Townsend's ground squirrel, sagebrush lizard, northern leopard frog, bull trout, margined sculpin, California floater, winged floater, Oregon floater, Columbia clubtail, white=belted ringtail and Columbia oregonian.
- Recovery plans are needed to guide conservation actions for threatened or endangered species such as American white pelican, sharp-tailed grouse or northern leopard frog. Management plans are needed for sensitive species such as common loon, peregrine falcon and margined sculpin.
- The populations of species that are important prey of golden eagle, ferruginous hawk, peregrine falcon and prairie falcon have declined.
- The expansion of West Nile virus into Washington poses a threat to sage-grouse and sharp-tailed grouse.

- Killing or persecution is a problem for many species: poisoning ground squirrels, shooting (plinking) American badger, Townsend's and Washington ground squirrel, destruction of multi-species winter snake dens that cause mortality of striped whipsnakes, and American white pelicans may be killed because of perceived competition with fishermen.
- Illegal persecution and harvest occurs for bald eagles and migrating and spawning fish species of concern.
- Declines of burrowing mammals have reduced availability of burrows for nesting by borrowing owls.
- The taking of some amphibians and reptiles can be a problem, including the frequent mortality of pygmy horned lizards after capture for pets, and the use of tiger salamanders for fishing bait.
- Bull trout is susceptible to overharvesting.

Lack of biological information on species and habitats:

- Data are needed on population trends in state-listed species such as pygmy rabbit, American white pelican, sage-grouse, sharp-tailed grouse, ferruginous hawk and northern leopard frog.
- Information is needed about the status of populations of state candidate species including Merriam's shrew, Washington ground squirrel, Townsend's ground squirrel, white-tailed jackrabbit, black-tailed jackrabbit, golden eagle, western grebe, burrowing owl, sage thrasher, sage sparrow, loggerhead shrike, striped whipsnake, sagebrush lizard, Columbia spotted frog, bull trout, river lamprey leopard dace, mountain sucker, Mann's mollusk-eating ground beetle, Yuma skipper, juniper hairstreak, Shepard's parnassian, silver- bordered fritillary, and California floater.
- There is a lack of data on habitat needs and limiting factors, demographics and dispersal for ferruginous hawk and northern leopard frog.
- An efficient survey methodology is needed for jackrabbits.
- Additional information is needed on the current distribution and abundance of American badger, pygmy horned lizard, tiger salamander, Pacific lamprey, white-belted ringtail, Columbia clubtail and Columbia oregonian.
- Additional information is needed on the current distribution, taxonomy or demographics and biology of winged floater, western floater, Oregon floater, western ridged mussel and western pearlshell.
- Data are needed to determine whether the amount and configuration of habitat will support a viable population of pronghorn if they were to be reintroduced.
- The possible role of disease in recent declines of jackrabbits and Townsend's and Washington ground squirrel needs investigation.
- Data is needed on gene flow and genetic diversity in bull trout.
- There is a shortage of adequate spatial inventory and assessment data on most habitat types.
- There is an absence of baseline data on the habitat values and functions of natural wetlands and a poor understanding of the status of resident macroinvertebrates in aquatic systems.

Habitat loss, conversion, fragmentation and degradation:

- The Palouse grasslands are one of the most endangered ecosystems in the United States. Only one percent of the original habitat remains in highly fragmented patches, most smaller than 10 acres.
- Loss, fragmentation and degradation of shrub-steppe and native grassland habitat are the likely causes of declines in many species including greater sage-grouse,

sharp-tailed grouse, ferruginous hawk, American badger, jackrabbits, pygmy rabbit, ground squirrels, golden eagle, prairie falcon, burrowing owl, sage thrasher, loggerhead shrike, sage sparrow, pygmy horned lizard and striped whipsnake.

- Large-scale wildfires can eliminate sagebrush for over 30 years, thereby resulting in habitat loss and degradation for species dependent on sagebrush, particularly sage-grouse, pygmy rabbit, sage sparrow, sage thrasher and striped whipsnake. The resulting increase in cheatgrass in turn increases fire frequency, further degrading the vegetation and habitat value of the area.
- Rural development in canyons affects Mann's mollusk-eating ground beetle and Shepard's parnassian.
- Loss of juniper due to development and land management practices affects juniper hairstreaks.
- Wetland drainage, altered hydrology or succession of wetlands can eliminate habitat of redhead, northern leopard frog, Columbia spotted frog, silver-bordered fritillary and Columbia oregonian, and cause loss of vegetation for feeding in winter range of redhead.
- Conversion to agriculture, residential development and stabilization of dunes eliminates habitat of sagebrush lizards.
- Suburban sprawl is a concern for resources managers as indicated by the growing number of ranchettes and residential subdivisions in previously managed forest and cropland. Development often occurs near lakes or streams and poses an increased threat of fire and impacts to water quality.

<u>Incompatible land management practices</u>:

- Degradation of shrub-steppe from improperly managed grazing, cheatgrass and invasive weeds, or inappropriate use of herbicides affects pygmy rabbit, sage-grouse, sharp-tailed grouse, sage thrasher, sage sparrow, sagebrush lizard and many other species.
- The destruction of cryptobiotic crusts by livestock trampling or vehicle traffic results in an increase in erosion and invasion by cheatgrass and weeds.
- Logging, agriculture, road building, or other activities that elevate water temperature may also alter hydrology, increase sedimentation, and degrade habitat of bull trout, margined sculpin, inland redband trout, California floater, winged floater and Oregon floater.
- Livestock pose a trampling hazard and improperly managed grazing has degraded vegetation at sites with Columbia oregonian, Mann's mollusk-eating ground beetle and Yuma skipper.
- Herbicide overspray negatively impacts shrub-steppe and Conservation Reserve Program lands adjacent to cropland.
- Improper grazing and pesticide use as well as other land management practices may reduce nectar plants and affect butterflies such as the juniper hairstreak and Shepard's parnassian.
- Mining of basalt and sand for roads and construction negatively impacts reptiles such as sagebrush lizard and striped whipsnake.
- Modern agricultural practices often reduce the quality, patch size and connectivity of wildlife habitat in farmlands.

<u>Alien and invasive plant and animal species</u>:

- Predation by bullfrogs and/or introduced predatory fish negatively impact northern leopard frog, Columbia spotted frog and tiger salamanders.

Carp and mosquitofish degrade habitat of northern leopard frog, westslope cutthroat, bivalves, Columbia clubtail and white-belted ringtail.
- Non-native trout such as brook trout compete with, and may hybridize with, bull trout.
- Westslope cutthroat hybridize readily with rainbow trout, and tiger salamanders may be affected by genetic pollution with out-of-state larva used as fish bait.
- Competition from *Corbicula*, an Asian clam, may affect the California floater, winged floater and Oregon floater.
- Blackberries are degrading habitat of the Columbia oregonian.
- Noxious weeds including yellow starthistle, spotted and diffuse knapweed, rush skeletonweed, introduced wetland plants such as Russian olive, leafy spurge, tamarisk, pepperweed and purple loosestrife, and invasive annual grasses, especially cheatgrass, are pervasive and have taken over thousands of acres of wildlife habitat within the Columbia Plateau ecoregion. Most of these alien plants are unpalatable to both wildlife and livestock.
- Cheatgrass stabilizes dunes, eliminating populations of sagebrush lizards.
- Reed canary grass thrives in reservoirs and wetlands stream outlets where water levels fluctuate, and directly affects habitats that support 27 Washington state-listed plant species. A number of native fish, amphibians and other wildlife species are not well adapted to spawn or reproduce in reed canary grass thickets.

Human disturbance and recreational impacts:

- Human disturbance can be a significant problem for certain nest sites of ferruginous hawk, peregrine falcon, prairie falcon, bald eagle and golden eagle and at nesting colonies of American white pelicans.
- Human disturbance can be a significant problem at breeding or maternity roosts and hibernacula of Townsend's big-eared bat.
- Recreational boating can create disturbance problems for redhead, common loon, western grebe and foraging bald eagles. Eagles often avoid foraging in water around stationary boats.
- Recreational activities such as offroad recreational vehicles, horses, mountain bikes and even hikers can create unauthorized trails that may disturb soil, allow invasive plants to establish, and degrade dune habitats of sagebrush lizards.
- The nature and timing of agricultural disturbances may be increasingly hazardous to wildlife. Tilling, planting and harvesting are becoming more synchronous, widespread and intense, potentially stressing wildlife during critical periods of nesting, rearing and dispersal.
- Mortality of lesser scaup ducks from fishing lines may be significant.
- Improper use of agricultural chemicals may impact northern leopard frog and Columbia spotted frog.

Environmental contaminants:

- Common loons are often poisoned by lead fishing sinkers. Bald eagles and golden eagles are occasionally poisoned after eating dead or injured waterfowl or other game animals that contain lead shot or bullets.
- Concentrations of DDE, PCBs and dioxins from prey causes reduced reproduction of bald eagles on the Columbia River. Eagles, peregrines and prairie falcons concentrate persistent chemicals such as DDE and PCBs that can cause eggshell thinning, making them vulnerable to any persistent toxic chemical.
- Agricultural chemicals potentially impact northern leopard frog and Columbia spotted frog.

Incompatible transportation and energy development:

- Tall structures such as wind turbines and electrical transmission towers and lines are known to reduce or eliminate nesting by some birds in non-forested habitats. These utilities should not be located where they will substantially impact the recovery of sage-grouse and sharp-tailed grouse. These structures may also impact sage thrasher, sage sparrow, loggerhead shrike and other species.
- Oil and gas development present another set of potential issues related to disturbance of wildlife and habitat.
- Expansion of oil and gas development in the Columbia Plateau ecoregion presents another set of potential issues related to disturbance of wildlife and habitat.

CONSERVATION ACTIONS

Conserve and recover wildlife species and populations: includes population management, protection of known populations, population augmentation and or reintroduction, control and monitoring mortality, enhancement of food sources/prey.

- Implement recovery actions for pygmy rabbit, sage-grouse, sharp-tailed grouse, ferruginous hawk and bull trout.
- Develop or finalize recovery plans for the American white pelican, northern leopard frog, sharp-tailed grouse and bull trout and conduct translocations to reintroduce or augment populations as needed.
- Develop management plans for sensitive species such as margined sculpin and common loon.
- Continue to conduct translocations to augment or reintroduce populations of sharp-tailed grouse in cooperation with British Columbia and Idaho.
- Monitor the impact of West Nile virus on sage-grouse and sharp-tailed grouse.
- Consider adding pygmy horned lizard to the list of protected wildlife.
- Consider ways to reduce the killing of American badger and Townsend's ground squirrel, Washington ground squirrel and other burrowing rodents that create habitat features used by burrowing owls, reptiles, tiger salamanders and other wildlife species.
- Consider adding winter dens of snakes to protected wildlife code.
- Complete the Washington Bat Conservation Plan.

Conduct research, assessment and monitoring: includes species and habitat distribution, abundance, limiting factors, suitable habitat and population trends.

- Monitor populations of pygmy rabbit, sage-grouse, sharp-tailed grouse, ferruginous hawk, northern leopard frog and bull trout to determine whether recovery objectives are being met.
- Determine the status of candidate species including Merriam's shrew, Townsend's big-eared bat, Washington ground squirrel, Townsend's ground squirrel, white-tailed jackrabbit, black-tailed jackrabbit, golden eagle, western grebe, burrowing owl, sage thrasher, sage sparrow, loggerhead shrike, striped whipsnake, sagebrush lizard, Columbia spotted frog, river lamprey, leopard dace, mountain sucker, Mann's mollusk-eating ground beetle, Yuma skipper, juniper hairstreak, Shepard's parnassian, silver-bordered fritillary and California floater.
- Determine the abundance and distribution of American badger, Kincaid meadow vole, pygmy horned lizard, white-belted ringtail, Columbia clubtail, western floater, winged floater, Oregon floater, western ridged mussel, western pearlshell and Columbia oregonian.
- Investigate limiting factors, demographics and dispersal of northern leopard frog, ferruginous hawk, burrowing owl and golden eagle.
- Monitor post-downlisted populations of peregrine and bald eagle for signs of decline that could result from bioaccumulation of contaminants or other factors.
- Conduct genetic studies of American badger, Washington ground squirrel, Townsend's ground squirrel, white-tailed jackrabbit, black-tailed jackrabbit, golden eagle, western grebe, burrowing owl, sage thrasher, sage sparrow, loggerhead shrike, striped whipsnake, sagebrush lizard, Columbia spotted frog, river lamprey, leopard dace, mountain sucker, Mann's mollusk-eating ground beetle, Yuma skipper, juniper hairstreak, Shepard's parnassian and silver-bordered fritillary.
- Determine whether the Columbia River tiger beetle is still present in Washington.

- Conduct extensive distribution and relative abundance surveys of rare native fishes, including leopard dace, mountain sucker, and margined sculpin; research effective sampling techniques.
- Conduct feasibility study for the reintroduction of pronghorn that evaluates habitat quality, quantity and distribution.
- Investigate the role of disease in ground squirrel and rabbit populations.
- Survey and map distribution of Pacific lamprey; develop methods to differentiate between species of lamprey.
- Support taxonomic and demographic studies of western floater, California floater, winged floater, Oregon floater, western ridged mussel and western pearlshell.
- Assess and map important habitats and areas of high biodiversity in the ecoregion using ecoregional assessments, local habitat assessments, Interagency Vegetation Mapping Project, and other habitat inventories and plans. Update ecoregional assessments every five years.
- Develop statewide land cover and threats data layers to improve connectivity between priority conservation areas.
- Identify and assess key connectivity areas and wildlife corridors between fragmented habitats and between protected areas. Restore habitat connectivity and wildlife corridors where appropriate on both public and private lands.
- Improve understanding of the ecological processes of seeps, bogs, wet meadows, forested wetlands, marshes, springs and other wetlands, and how they are impacted by human development.
- Conduct hydrologic studies that include water quantity and chemical budgets at wetlands known to be supporting rare and endangered species. Use this information to inform wetland management.
- Inventory and prioritize riparian habitat types and attributes needing protection and conservation.
- Identify important habitats for restoration and assess the feasibility of successfully restoring these sites. Include an evaluation of current and projected land use in and adjacent to potential restoration sites.

<u>Protect, restore and connect habitats</u>:

- Identify and protect essential habitat through management agreements, easements, or acquisitions as needed to recover listed species including ***pygmy rabbit***, sage-grouse, sharp-tailed grouse, northern leopard frog, and ferruginous hawk.
- Restore degraded shrub-steppe and grassland habitat on public lands for listed and candidate species.
- Identify and protect shrub-steppe and grassland habitats used by listed and candidate species from agricultural conversion, residential and recreational development through management agreements, easements, livestock fencing, etc.
- Identify private agricultural land that is important for connectivity for shrub-steppe species and facilitate enrollment in the Conservation Reserve Program when appropriate.

- Protect areas on public and military lands with undisturbed microbiotic crusts from livestock trampling or vehicle traffic and facilitate research on its importance for shrub-steppe communities in Washington.
- Research methods of controlling cheatgrass and restoring shrub-steppe vegetation.
- Continue to require bald eagle habitat plans that include retention of trees; enforce/strengthen Shoreline Management Act.
- Map and protect essential habitat for Mann's mollusk-eating ground beetle, Shepard's parnassian, Yuma skipper and juniper hairstreak.
- Preserve wetlands for greater sandhill crane, lesser scaup, redhead, greater scaup, northern leopard frog and Columbia spotted frog through incentives, management programs, or acquisitions.
- Investigate mitigation alternatives for impacts of dams on winged floater and Oregon floater.
- Document, limit access, and protect roosting and hibernacula sites for Townsend's big-eared bat.
- Monitor habitat condition at Columbia oregonian sites and pursue the possibility of permanent protection through easements or agreements.
- Protect rare or special habitat types such as alkaline ponds, vernal pools, inland dunes, juniper savannahs, scattered conifer stands, caves, cliffs, rocky outcrops and talus.
- Prioritize conservation areas using ecoregional assessments and other biological assessments. Protect important habitat types, biodiversity areas, and environmentally sensitive lands that should not be altered through a variety of techniques including acquisitions, conservation easements, life estates and cooperative agreements with willing landowners.
- Coordinate with local land trusts, conservation districts and other conservation organizations and agencies to conserve important habitat on both public and private land. Focus limited resources in regionally significant areas. Identify all possible acquisition and restoration grants and coordinate applications.
- Work with the USDA Forest Service, U.S. Army Yakima Training Center and other public landowners to protect existing roadless areas and expand the roadless area network where justified for habitat protection and connectivity.
- Protect key connectivity areas and wildlife corridors between fragmented habitats and between protected areas through a variety of techniques including acquisitions, conservation easements, life estates and cooperative agreements with willing landowners. Use statewide land cover and threats data layers to improve connectivity between priority conservation areas.
- Restore native habitats, habitat connectivity and wildlife corridors where appropriate on both public and private lands. Consider restoring lands adjacent to existing protected areas to increase their effective size and function as wildlife habitat.
- Purchase water rights from willing sellers in unregulated tributaries; use these water rights to restore and maintain adequate year-round flows for both instream and out-of-stream riparian fish and wildlife habitat.
- Rehabilitate and restore stream channels, floodplain functions, riparian habitat and connectivity where streams have been diverted, fragmented or degraded. Use livestock exclusions, instream structures, bank modifications and other methods.
- Preserve and/or restore buffer areas in appropriate locations along tributaries and mainstem waterways to a condition that is adequate to maintain healthy, functioning riparian zones for the ecoregion's rivers and estuaries.
- Work with public and private landowners to reestablish and restore native shrub-steppe and grassland plant communities in selected public and private habitat areas to support species at risk and increase species richness.

Improve land management practices:

General

- Protect shrub-steppe from wildfires that remove sage-brush and increase cheatgrass.
- Influence grazing practices in shrub-steppe and grassland to protect habitat values for pygmy rabbit, sage-grouse, sharp-tailed grouse, sage thrasher and sage sparrow.
- Maintain stream buffers during timber harvest and conduct proper land use management to protect bull trout, mountain sucker, inland redband trout, margined sculpin, leopard dace and bivalves.
- Prevent livestock grazing on riparian habitat of Lewis' woodpecker, Mann's mollusk-eating ground beetle, Shepard's parnassian, and Columbia oregonian.
- Allow natural disturbances and successional functions and processes to occur on conserved wetlands.
- Manage undeveloped publicly-owned land for conservation of priority habitats and species.

Fire management

- Work with public agencies and private landowners to reduce the potential destructive impact of wildfires on native habitats by incorporating measures such as fire breaks and prescribed burning, where appropriate, into wildlife and land management plans.
- Reduce cheatgrass and restore native vegetation to reduce fire frequency.

Forest management

- Protect remaining old growth conifer and hardwood stands to benefit late successional species and manage some stands on long rotations (>200 years).
- Work with the Department of Natural Resources and the State Forest Practices Board to develop, implement and enforce forest practices regulations to enhance biological diversity on existing state and private managed and protected areas.
- Work through the State Forest Practices Board and directly with forest landowners to implement forest management prescriptions, including prescribed burns, which will maintain and enhance biodiversity and natural ecosystem functions. Encourage modified silvicultural prescriptions that promote local topographic, soil and vegetative conditions.
- Encourage the development of selective harvest policies and guidelines on both public and private forest land that will leave adequate components of old growth habitat such as snags and downed wood and some live trees as habitat for associated wildlife such as flammulated owls and white-headed woodpeckers.
- Minimize logging roads and decommission them after the period of entry. Ensure that all logging and forest access roads are located in stable, non-erodible areas and outside riparian management zones.
- Ensure the integrity of riparian habitat by maintaining adequate riparian management zones along streams in all logging sites, on both public and private land.
- Support implementation and enforcement of the Washington Forest Practices Act to accomplish habitat conservation and regeneration on both state and private forest lands.
- Encourage public and private forest landowners to manage forested watersheds that maintain an appropriate mix of successional stages and provide connectivity of riparian and upland vegetation as protected travel corridors for wildlife.

Grazing and agricultural practices

- Work with public and tribal and management agencies to fence or otherwise protect riparian zones from livestock grazing and unauthorized offroad vehicle use. Consider retirement rather than renewal of grazing leases on sensitive lands.
- Work with conservation districts, Natural Resource Conservation Service, USDA Forest Service, U.S. Army and private landowners to implement best management practices in riparian areas and associated upland habitat in conjunction with the Conservation Reserve Program, Wetland Reserve Program and other Farm Bill programs.
- Use the Comprehensive Resource Management Plan process for large landscapes with a mix of public and private landowners to modify grazing regimes, improve grassland and shrub-steppe understory conditions, and enhance biodiversity.
- Assist private landowners in securing funding to fence riparian zones on private land. In areas where it is impractical to exclude livestock, protect habitat quality by controlling the timing and intensity of livestock grazing through regulation and landowner agreements.
- Work with private and public landowners to minimize the impacts on habitat and wildlife from modern agriculture, including agrochemical use, water use, grazing and soil erosion.
- Ensure that grazing leases on state lands comply with HB1309 “Ecosystem Management Standards” to maintain fish and wildlife habitat.

<u>Control and prevent introduction of alien and invasive species</u>:

- Control bullfrogs and predatory fish as needed to protect northern leopard frog, Columbia spotted frog and ***tiger salamander.***
- Avoid introduction of non-native fish in fishless lakes and where species of conservation concern occur such as bull trout, westslope cutthroat trout and native amphibians and reptiles. Avoid introduction of rainbow trout or only introduce sterile fish where westslope cutthroat are found. Avoid introduction of non-native trout to protect bull trout from hybridization, competition and predation.
- Prevent introductions of alien competitors of western floater, California floater, winged floater and Oregon floater through enforcement and education.
- Control blackberries affecting Columbia oregonian sites.
- Control infestations of knapweeds, rush skeleton weed, and other weeds to prevent degradation of shrub-steppe and grassland habitats.
- Develop a regional plan for the detection, rapid response and eradication of invasive species.
- Work with other public agencies and private agricultural organizations such as the Farm Bureau and Washington Grange to develop basic techniques for mapping and monitoring the spread of invasive plant species over time.
- Participate in federal and state agency partnerships to develop and implement weed control strategies for impacted sites and ecosystems. Promote adequate funding and coordination of weed control efforts on both public and private lands using environmentally sound methods.

- Develop educational and public information materials to increase public awareness of the ways that invasive alien species are introduced to sensitive ecosystems.
- Provide funding, incentives and technical assistance to private landowners to eliminate undesirable invasive plant species in riparian zones and to restore native plants that provide important habitat for native fish and wildlife. Use integrated pest management practices to control currently established invasive species with help from volunteers.
- Participate in federal and state agency partnerships to develop and implement cheatgrass and weed control strategies for impacted sites and ecosystems.
- Control alien plants such as purple loosestrife and Russian olive and prevent their proliferation on public and private land by removal, controlling livestock levels, and avoiding large-scale soil disturbances.

Control and monitor disturbance:

- Protect nesting golden eagle, bald eagle, peregrine falcon and prairie falcon through use and access restrictions on public lands as needed, and work with private landowners and permitting agencies to prevent blasting or construction disturbance during nesting. Inform rock climbers of sensitive periods and locations to reduce disturbance of nesting peregrine, golden eagle, and prairie falcon.
- Strictly control access to islands with ***American white pelican*** colonies.
- Strictly control location information for sage-grouse and sharp-tailed grouse leks and nesting sits of falcons, eagles and ferruginous hawks to prevent disturbance and trespass on private property.
- Eliminate vehicular access and campsites in conservation areas identified as sensitive habitats such as bogs, prairies, and dunes.

- In sensitive habitats, manage both land and water access by using fencing, trails, elevated boardwalks, railings, seasonal restrictions, signage and livestock restrictions.
- Reduce the amount and impact of unauthorized recreational access and use on important wildlife habitat through better enforcement of existing laws, more fencing and posting of critical habitat areas, selective road closures and increased public education and information for recreational users and user groups.

Control and prevent environmental contamination:

- Facilitate use of nontoxic alternatives to lead shot and lead fishing sinkers.
- Work with other agencies to reduce and remediate sources of contaminants that contribute to prey contamination for bald eagle, peregrine falcon, etc.
- Work with governmental and nonprofit agencies to develop an ecoregion-wide strategy for identified toxins and other pollutants: their sources, destinations and effects, and ways to reduce their discharge.

- Work with other agencies, industry and private landowners to encourage use of integrated pest management techniques and phase out the use of pesticides and herbicides.
- Clean up contaminated sites and sediments whenever possible and prevent further toxic contamination of areas, including unconfined spoil disposal sites.
- Reduce the use of hazardous chemicals by continuing to implement the persistent bioaccumulative toxins strategy and by using a variety of best management practices and improved treatment methods.
- Continue to place a priority on actions to prevent and respond to oil and hazardous material spills.

Improve transportation and energy development:

- Work with land management agencies, utility licensing agencies, and telecommunications and energy companies to ensure that the placement of new windpower or cell towers does not negatively affect sage grouse, sharp-tailed grouse, and other shrub-steppe associated wildlife species, migrating birds, or bats.
- Avoid roadbuilding or provide crossings where mortalities of striped whipsnake are a problem.
- Reduce mortalities of raptors through modification of electric transmission and distribution lines.
- Work with the Washington Department of Transportation to locate highways away from important wildlife habitats and biodiversity areas. If impacts are unavoidable, design adequate mitigation such as underpasses, overpasses and fencing to accommodate wildlife that need passage, such as American badger and western toads near breeding sites.

Improve water quantity and quality:

- Reduce sedimentation and pollution to conserve bull trout, mountain sucker, inland redband trout, margined sculpin, leopard dace, Columbia clubtail, white-belted ringtail, western floater, California floater, winged floater, Oregon floater, western ridged mussel and western pearlshell.
- Manage wetland areas on public land for both high water quality and habitat value. Ensure that the water quality of inflow does not lead to deterioration of the wetland habitat.
- Where possible, restore or rehabilitate the hydrology, water quality and native plant communities in degraded and disturbed wetlands. Methods should emphasize creating or restoring natural wetland functions such as conserving beaver populations and dynamic stream processes to benefit species.
- Manage runoff from highways according to the updated highway runoff manual. Improve the road drainage network in riparian zones by removing unnecessary culverts, increasing the size of inadequate culverts, or replacing culverts with bridges.
- Reduce the harm from stormwater runoff by working to improve the effectiveness of the National Pollutant Discharge Elimination System stormwater permit programs.
- Assist local jurisdictions in finding solutions to increase landowner compliance with onsite sewage system maintenance and animal waste management practices through education and regulated inspection. Work to reduce the number and volume of combined sewer overflow events.
- Study the effects of chemicals applied to irrigation systems on riparian habitat and wildlife. For example, irrigation waters transported in open, unlined canals can seep

into adjacent soils, eventually carrying soluble pollutants into ground or surface waters.

Improve coordination, planning, permitting and mitigation:

- Protect nesting golden eagle, ferruginous hawk and prairie falcon by maintaining buffer zones of no activity during nesting
- Provide credible scientific information on priority habitats and species and biodiversity areas, their significance, management needs and compatible land uses to decision-makers at site, local and regional scales.
- Provide technical assistance to counties in using fish and wildlife and biodiversity information to update comprehensive land use plans, community or watershed plans, Shoreline Master Plan, etc.
- Assist counties in developing and updating county ordinances and incentives that help to mitigate or control development in areas with resource and conservation values, and that encourage environmentally-sensitive development in growth areas.
- Work with local governments and conservation organizations to identify and protect areas of important habitat and biodiversity through existing environmental laws and other local programs.
- Encourage floodplain management and shoreline zoning protection programs.
- Develop a coordinated conservation vision and strategy for conservation of large landscapes using a structured process like The Nature Conservancy's 5-S Project Management System or the Cascade Dialogs.
- Review state and federal land management plans to ensure adequate protection for priority habitats and species, biological diversity and ecosystem health.
- Develop site management plans for protected areas.
- Work with public and tribal land management agencies to protect important habitat and areas of high biodiversity from loss and fragmentation, as well as degradation.
- Coordinate and integrate species recovery and management plans with land management and watershed plans using regulatory and voluntary approaches.
- Participate in Growth Management Act, Shoreline Management Act, Forest Protection Act and Federal Energy Regulatory Commission permitting processes for new or expanded residential, recreational or hydropower development on private land.
- Use information from ecoregional assessments to illustrate important habitats and areas of high biodiversity. Encourage permitting agencies to designate and protect these areas from residential and recreational development, and to require mitigation for habitat conversion and fragmentation where it occurs.
- Work closely with the USDA Forest Service and other land management agencies to prevent or mitigate potential adverse impacts to fish and wildlife habitat from proposed recreational or hydropower development on public lands.
- Work with regulatory agencies to design effective mitigation strategies for projects that result in wildlife impacts or direct conversion or fragmentation of habitat.
- Assist federal agencies in implementing the Interior Columbia Basin Ecosystem Management Strategy.
- Represent WDFW's conservation interests on interagency recovery teams and working groups.

Improve enforcement of laws and regulations:

- Protect American white pelican, bald eagle, and other endangered wildlife from killing and persecution through enforcement, education and outreach.
- Reduce the amount of illegal shooting (plinking) of ***Washington ground squirrels.***
- Enforce nontoxic shot requirements for waterfowl hunting to protect bald eagle and peregrine falcon.
- Enforce restriction on transplantation of non-native fish to protect bull trout and northern leopard frog, Columbia spotted frog, tiger salamander and other native amphibians.
- Reduce illegal harvest of bull trout.
- Enforce recreational access restrictions on public lands and aquatic areas.

Improve landowner assistance:

- Work with large and small timber companies and landowners to accomplish habitat conservation through nonregulatory approaches such as landowner incentives, conservation easements, habitat conservation plans and acquisition of critical habitat from willing landowners.
- Secure state and federal tax incentives that discourage habitat fragmentation and destruction and that encourage landowners to protect and manage their land to benefit wildlife habitat.
- Work with local government to implement the Public Benefit Rating System and encourage effective use of open space tax incentives for landowners.
- Work with private landowners to identify and protect areas with important habitats and biodiversity, and protect these areas through landowner incentives and other nonregulatory programs.
- Provide educational materials to private landowners that describe management techniques for maintaining and restoring various wildlife habitats.
- Work with private landowners to identify and protect important wetland habitats and buffers by providing adequate water, controlling invasive plants, reducing disturbance to nesting wildlife, and fencing or otherwise keeping livestock out of wetlands and associated upland habitat.
- Influence the application of federal Farm Bill funds, including the Conservation Reserve Program and the WDFW Landowner Incentive Program, on private agricultural lands most critical for wildlife movement and most suitable for restoration of native wetlands, shrub-steppe and grassland habitat.
- Promote grant programs to assist landowners with implementation of management plans.
- Develop, periodically update and provide WDFW Priority Habitats and Species management recommendations to assist landowners in conserving priority habitats and species.

Improve wildlife conservation education: includes outreach, volunteer and watchable wildlife programs.

- Discourage control of ground squirrels and other mammalian prey of golden eagle, ferruginous hawk and prairie falcon, and discourage killing of American badger and other burrowing mammals that create burrowing owl nest sites.
- Develop educational materials and programs targeted to fishermen to reduce mortality of lesser scaup from fishing line.
- Develop education program targeted to reduce disturbance of redhead, loons, bald eagles and western grebes by boaters.
- Discourage persecution of snakes in winter dens that kills striped whipsnakes and other species.
- Discourage capture of pygmy horned lizards for pets and the use of tiger salamanders as bait.
- Develop educational programs for conservation of burrowing owls in the urban and rural environments.
- Engage and involve local and tribal governments, state and federal agencies, organizations and citizens in efforts to protect and restore priority habitats and species through a variety of outreach projects, programs and education efforts.
- Increase the use of citizen science for the collection of data, monitoring, restoration and conservation of important habitats and associated wildlife species. Coordinate volunteer monitoring and involvement.
- Promote and maintain public information and education efforts that focus on endangered species, habitat loss, ecological function, biological diversity and environmentally aware lifestyle practices. Emphasize the connection between habitat and environmental quality and human health and welfare.
- Expand conservation education programs for both adults and children to emphasize the critical nature and vulnerability of sensitive habitats such as wetlands and grassland habitats and associated wildlife.
- Connect with user groups through education to make them part of the conservation solution in areas that have high recreation values.
- Work with large corporations to increase awareness and develop financial support for conservation of biodiversity.

VII. MONITORING AND ADAPTIVE MANAGEMENT

Monitoring is a key element in fulfilling the Washington Department of Fish and Wildlife's mission of preserving and perpetuating Washington's fish and wildlife resources. This is directly reflected in the 94 detailed performance measures included within WDFW's biennial strategic plan. An example of a performance measure is the number of Western pond turtles hatched in captivity and released to the wild. The performance measures are updated quarterly or annually, making the strategic plan a coarse-level tool for tracking progress of agency priorities. It summarizes data developed from more in-depth monitoring of fish, wildlife and habitat resource conditions.

WDFW engages in four general types of monitoring activities as defined below:

- *Status and Trends (extensive) monitoring* to track changes in wildlife and fish populations and their associated habitats over time, such as tracking the population status of four target species in a bioreserve.

- *Research (intensive) monitoring* to identify cause-and-effect relationships between physical habitat conditions, ecological processes, land use practices and/or conservation strategies and the animal populations of interest, such as identifying the factors contributing to a population decline in one of the target species in a bioreserve.

- *Effectiveness monitoring* to document the success of conservation actions in achieving the desired resource condition, such as determining whether a prescribed burn on the bioreserve achieved the desired result of maintaining a plant community of native prairie grasses.

- *Implementation monitoring*, or compliance monitoring, to confirm that planned conservations were implemented, such as documenting that a bioreserve was created to preserve habitat for four target species.

While the state Comprehensive Wildlife Conservation Strategy is required only to address status and trend monitoring and effectiveness monitoring, WDFW believes that research and implementation monitoring are also important in achieving success in our conservation actions. WDFW monitoring activities are therefore described by each of these four categories in turn. Monitoring programs are designed to answer specific research questions. The sampling protocols and design, including the spatial and temporal scale of the monitoring effort and the timeframe for reviewing the adequacy of the monitoring program, are thus driven by traits of the species or species group being studied, such as size and home range, reproductive strategy, life history, etc. Because of the unique methodology often required to answer specific research questions, monitoring can be very costly. Where feasible, new WDFW monitoring programs incorporate existing data and surveys and collaborate with monitoring partners.

The sections that follow provide an overview of WDFW monitoring program highlights and refer the reader to more detailed plans and programs described in the CWCS appendices. Agency tools employed to conduct monitoring programs are also described. To enhance monitoring capabilities, WDFW has relied on a great number of partnerships, which are outlined in this chapter. Finally, this chapter identifies future directions for monitoring and outlines a plan for adaptive management and future revisions of the monitoring component of the CWCS.

A. Status and Trends

Various fish and wildlife species, groups of species, and their associated habitats are currently monitored by WDFW and other conservation partners to determine changes and trends in their status over time. Development of the Comprehensive Wildlife Conservation Strategy (CWCS) in 2005 resulted in a new Species of Greatest Conservation Need (SGCN) list for Washington (Appendices 1 and 2). This also led to WDFW reexamining how it classifies and prioritizes wildlife species and associated habitats in light of new funding requirements and expectations of the State Wildlife Grants program. Monitoring activities are currently in place for some of the roughly 200 species included in the SGCN. Specific monitoring activities for each species are listed in the SGCN Population, Distribution, Problems, Strategies and Actions matrices (see Chapter IV, Species of Greatest Conservation Need). For the species for which monitoring is not currently underway, an explanation is also included in the above referenced appendices. WDFW will rely on the monitoring information compiled in Chapter IV to identify species that are currently inadequately monitored and to develop a strategy for developing a monitoring program for those species.

Species of Greatest Conservation Need and Associated Habitat

WDFW categorizes wildlife species into two broad groups to determine monitoring objectives, methods, outcomes and use of survey data. Wildlife diversity species include those species that are not hunted within the state; game wildlife is the traditional group of species that are hunted and provide consumptive recreation.

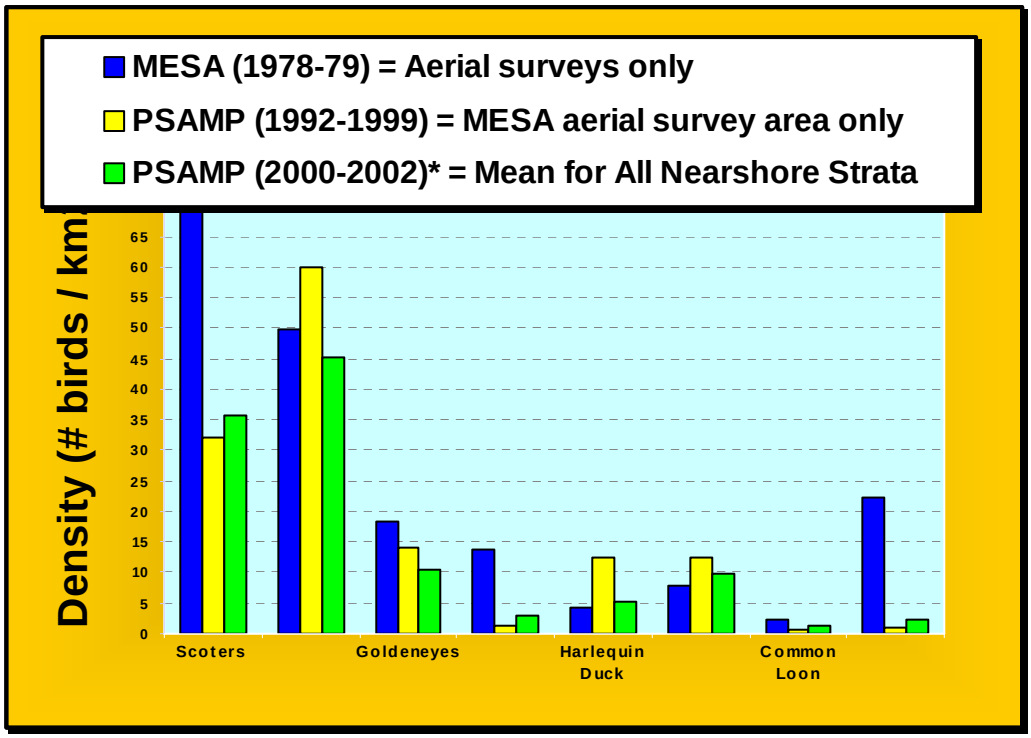
Wildlife Diversity Species Monitoring

Monitoring activities for wildlife diversity species were initiated in the 1970s within the former Washington Department of Game when interest in non-hunted species gained momentum, and the Wildlife Diversity Division was created (http://wdfw.wa.gov/wlm/diversty/diversty.htm). Baseline surveys or complete inventories are conducted to determine population numbers and distribution of wildlife species. Monitoring is structured as an annual activity or at periodic intervals of multiple years. Most of the surveys to date have concentrated on Washington species of concern—the endangered, threatened and candidate species. The objectives have been to determine status and trends of those species for the development of status review documents, recovery plans and landscape management plans such as Habitat Conservation Plans.

Population status monitoring of marine birds and waterfowl was initiated in 1992 through the Puget Sound Ambient Monitoring Program (PSAMP) (http://wdfw.wa.gov/mapping/psamp/). Aerial surveys of nearshore and offshore strata have been the primary tools used for monitoring marine birds and waterfowl throughout Washington's inner marine waters. These data, incorporated into GIS mapping systems, help describe spatial patterns in habitat use and changes in relative population indices over time. Other focus studies, concentrating on selected species and their particular demographics and habitat use, have been initiated after review of the apparent declines suggested by the aerial survey data. These efforts are helping to determine how marine avian species in the inner marine waters of Washington are responding to a changing marine environment as well as helping managers evaluate how different species depend on Washington habitats at critical stages in their life histories. This work has enabled comparisons with earlier data sets such as those collected during 1978-79 as part of the Marine Ecosystem Analysis (MESA) program administered by the National Oceanic and Atmospheric

Administration (NOAA). WDFW staff determined trends in densities over the 20-year interval for 18 species or key species groups that winter in Puget Sound (Figure 36).

Figure 36. Population status and monitoring of marine birds in Washington: Comparison of Relative Density Indices for Eight Species or Species Groups over the 1978-2002 period in Nearshore Waters of Inner Marine Waters of Washington.



Immediate needs for species protection, conservation and management have been the impetus for monitoring species such as spotted owls, marbled murrelets, sage-grouse, pygmy rabbits, peregrine falcons and bald eagles. As species such as peregrine falcons and bald eagles are delisted, their survey and monitoring needs change. For the purpose of site-specific environmental review data or management needs, baseline surveys for these species are done on an as-needed basis. More importantly, however, delisted species are monitored on a long-range plan to determine whether their populations start to decline again. The monitoring plans for peregrine falcons and bald eagles are designed to detect changes at a national level and apply sampling survey protocols that are designed to detect an established percentage of population declines that will trigger management actions.

In addition to monitoring species of concern, there is a growing need to initiate monitoring activities for the less familiar species listed in the SGCN. Baseline population status surveys for these species are hampered by a lack of knowledge of much of their biology and distribution. This is especially true for reptiles, amphibians and invertebrates. We also lack basic population information on many species that have been overlooked because they have been considered common, but may now be experiencing population declines from unknown causes. The great blue heron in western Washington, long a familiar icon of Puget Sound's rich fauna, is a good example. It has been losing nesting colonies at a steady rate.

Game Monitoring
Game species are monitored to evaluate their trends relative to the effects of different types of hunting seasons and to determine the numbers of animals that may be harvested when developing or modifying hunting seasons. Examples of these are pre- and post-hunting season big game surveys for elk, deer, bighorn sheep and moose. Breeding population surveys, midwinter counts and banding are conducted for waterfowl.

More information on game species monitoring is available in the WDFW Game Management July 2003-June 2009 and the Final Environmental Impact Statement for the Game Management Plan July 2003-June 2009, available at http://wdfw.wa.gov/wlm/game/management/.

Fish Species and Associated Habitat

Salmonids
WDFW has been monitoring Washington's wild salmonids since 1977. WDFW maps the geographic extent of spawning and rearing of salmonids throughout Washington, and data are updated on a three-year cycle. WDFW and co-manager treaty tribes conduct spawning surveys of 323 stocks of salmon and trout annually, and measure juvenile migrant production of salmon and trout at 34 locations statewide. Developing estimates of wild salmon production involves mass marking (adipose fin clipping) of an estimated 340 million hatchery salmon every year. WDFW annually monitors the status of all legally installed fish passage barrier repairs and reports the number of blockages discovered by inventory groups to assess progress in meeting state and federal salmon recovery goals.

Marine Groundfish and Forage Fish
Marine groundfish and forage fish abundance are estimated through a variety of survey types such as trawl, video and acoustics, and monitoring of catch and effort data. WDFW conducts periodic surveys on the distribution of forage fish eggs on a small percentage of spawning beaches each year to assist local governments in characterizing and protecting important nearshore habitats.

Shellfish
Shellfish (such as geoduck, razor clam and oyster) abundance is estimated through dive surveys, sampling at index sites and monitoring of catch and effort data.

B. Research Monitoring

Species of Greatest Conservation Need and Associated Habitat

A broad array of ecological research is underway at WDFW with the objective of deducing causal relationships between physical habitat, ecological processes, conservation actions and wildlife and populations. The brief summary included in this chapter lists some of the more prominent studies currently conducted by WDFW.

Several studies focus on the causal relationships between conservation management actions and target wildlife species. These include the impacts of the federal Conservation Reserve Program (CRP) on shrub-steppe wildlife, the reintroduction and monitoring of sharp-tailed grouse, and pygmy rabbit captive breeding. Population ecology monitoring is conducted for large raptors, mountain goats, tufted puffins,

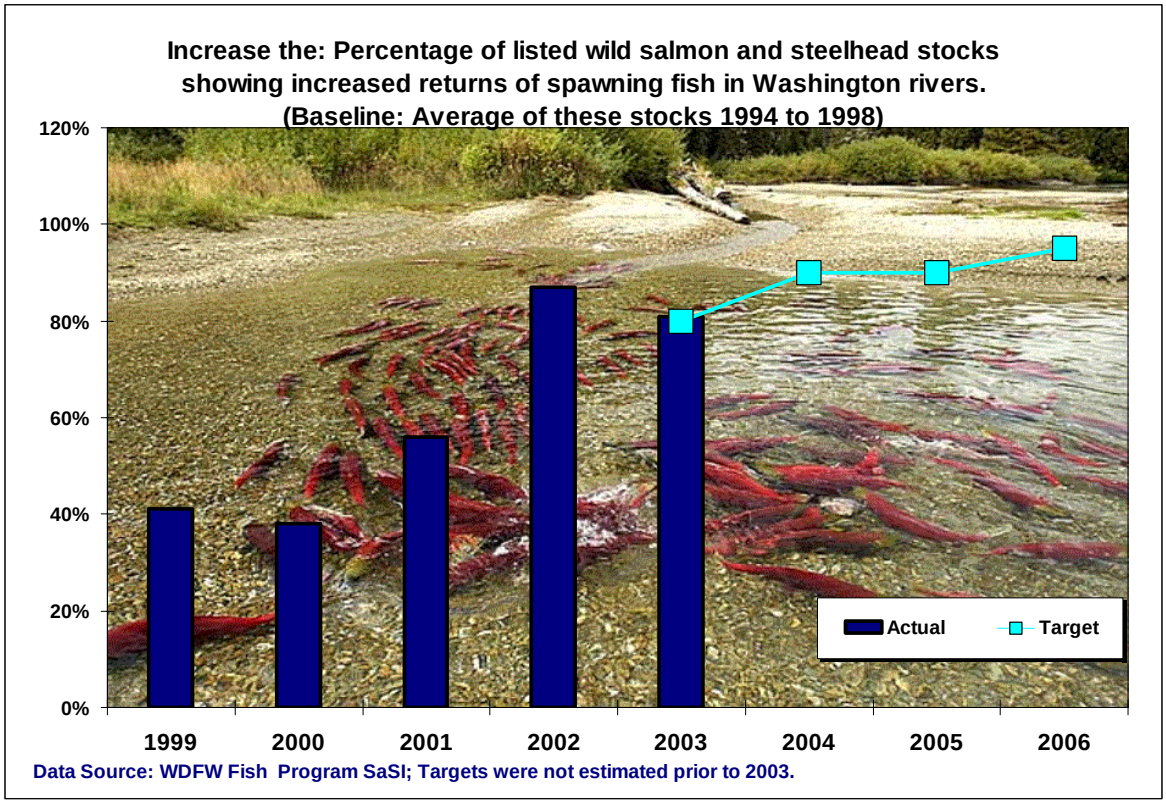
northern leopard frogs and Columbian white-tailed deer. Habitat relationship studies are carried out for Washington ground squirrels and western gray squirrels. Studies of the effects of disease and toxicology are underway for deer (notoedric mange) and marine mammals (PCBs, PBDEs) in killer whales.

Fish Species and Associated Habitat

Salmonids

Intensive research monitoring for salmonids is generally referred to as validation monitoring because the great body of knowledge surrounding anadromous salmon allows for hypothesis testing of the population response to specific management actions. WDFW conducts validation monitoring to also periodically reevaluate anadromous salmonid productivity, upon which fishery management is based (Figure 37). WDFW's hatchery program evaluates the effects of artificial production problems on wild salmonid stocks. Finally, WDFW has partnered with numerous cooperators to evaluate fish production responses to habitat and land use restoration treatments in 10 streams in western Washington in the Intensively Monitored Watershed Studies. See http://wdfw.wa.gov/fish/wild_salmon_monitor/publications/imw2004_report.htm.

Figure 37. Sample graph tracking spawning returns of listed wild salmon and steelhead stocks.



Marine Groundfish and Forage Fish

Puget Sound groundfish are surveyed using a stratified-random trawl survey. The two subbasins (northern and southern Puget Sound) are surveyed on an alternating year basis. A near-shore, quantitative video survey of rocky habitats provides information on these habitats. WDFW marine protected areas are monitored for trends in fish abundance, spawning activity and size distributions. Commercial and recreational catch are monitored. Two methods are used by WDFW to provide quantitative estimates of herring abundance: spawn deposition surveys and acoustic/trawl surveys. Using one of either of the two methods, WDFW currently estimates the abundance (spawning biomass) of each of the 18 recognized herring stocks in Puget Sound each year. Occasional assessments are conducted on the Washington coastal stock. Commercial catch and recreational catches are managed and monitored. In addition, long-term studies have been conducted regarding contaminant levels of fish in marine waters of Puget Sound.

Offshore assessment of the status of fish stocks is conducted through the Pacific Fishery Management Council (PFMC). The groundfish covered by the Council's groundfish fishery management plan (FMP) include 82 different species that, with a few exceptions, live on or near the bottom of the ocean. These stocks are now managed on a biennial cycle. Off the coast, PFMC operates triennial trawl surveys and conducts periodic stock assessments for the managed species. Highly migratory species require integrated management and assessment by a variety of nations. A variety of sources of information are integrated into the stock assessments for these fish. Coastal pelagic species also require integration of information among various states to determine the stock status for each species.

C. Effectiveness Monitoring

Effectiveness monitoring gauges the success of projects and programs in achieving their stated goals. The product of these monitoring efforts will be used to determine whether specific monitoring projects and programs should be continued, expanded, terminated or adapted to address new circumstances.

WDFW also periodically studies the effectiveness of Bonneville Power Administration habitat enhancement projects on WDFW Wildlife Areas. Game managers monitor hunting harvest and conduct polls to collect information on hunter recreational interests and feedback for hunting seasons.

Fish Species and Associated Habitat

WDFW participates in harvest monitoring through the Pacific Salmon Commission, Pacific Fisheries Management Council, North of Falcon Process, and Columbia River Compact to ensure that commercial and sport fisheries are aligned with population goals. WDFW's coded wire tagging program and its genetics laboratory also contribute to harvest monitoring. The coded wire-tagging program allows estimates of the percent contribution of Washington-origin salmon in the national and international fisheries of the North Pacific Ocean, and makes it possible to estimate marine survival and overall salmon productivity. The WDFW genetics laboratory provides information about stock composition of fishery catches in Washington and in neighboring states. In addition to harvest monitoring, WDFW evaluates the habitat and fish responses to site-specific habitat restoration actions that are conducted in the Intensively Monitored Watershed basins. WDFW contracts with landowners to

monitor fish screening devices in streams to ensure they are effective in preventing the passage of fish into irrigation canals, and monitors fishways in state-owned lands to ensure the free passage of fish over dams, spillways and complex road crossings.

D. Implementation (Compliance) Monitoring

Many of the conservation strategies and actions described in the Washington CWCS will be implemented by WDFW, either alone or in cooperation with other conservation partners. Other projects may be carried out solely by other conservation partners, either as part of their own mandates and programs or through funding arrangements with WDFW. Projects that are carried out and funded by WDFW will be monitored by WDFW to ensure that the funds were properly spent and to document that the projects were effective in addressing the CWCS. WDFW uses the Contract and Project System (CAPS), a new shared database system for tracking WDFW contracts and their associated projects. CAPS is designed to provide necessary management controls and reporting capabilities and to address the various programmatic and financial accountability expectations of federal, state and local contracting and grant agencies. WDFW has successfully used CAPS for compliance monitoring on several Federal Energy Regulatory Commission (FERC) projects, as well as in projects affected by Washington Forest Practice laws.

CAPS will be evaluated by WDFW and modified or expanded as necessary to ensure that it meets the expectations and requirements of the CWCS and the State Wildlife Grants program. A second monitoring tool for tracking progress towards CWCS strategies and actions is WDFW's biennial Strategic Plan (http://wdfw.wa.gov/depinfo/strategic_plan05-07.pdf). If the combination of CAPS and the Strategic Plan does not adequately track CWCS progress, new systems will be designed or acquired to meet these needs.

E. Monitoring Tools

WDFW has many data tools to facilitate monitoring activities related to CWCS implementation. Sophisticated data management systems are already in place to accommodate CWCS monitoring, as are interactive web applications making these data more easily accessible to conservation partners and the general public.

Data Management Systems

Many of the most current and sophisticated data management systems have been developed in recent years to address the weighty issue of Northwest salmon recovery. In many cases, due to a lack of funding, the development of terrestrial wildlife data systems lags behind those developed for the salmon recovery program.

WDFW employs powerful relational databases used in conjunction with geographic information systems (GIS) for data entry, automation, management, interpretation and public distribution. WDFW uses data models and platforms that conform to up-to-date industry standards. The most significant data sets supporting wildlife and fish monitoring efforts addressed in the CWCS include the Priority Habitats and Species Program, the Salmon and Steelhead Habitat Inventory and Assessment Program, and the Salmonid Stock Inventory Database.

Some of the most significant data sets supporting wildlife and fish monitoring efforts addressed in the CWCS are summarized below and in Chapter III, State Overview. Two of these three data sets were developed for salmon management and recovery.

Priority Habitats and Species (PHS). Established in 1989, PHS maintains a list of species and habitats that are currently recognized as conservation priorities by WDFW. The PHS list served as one of the source lists for creating the SGCN list developed for the CWCS. In addition to periodically updating the list of priority species and habitats, PHS maintains mapped data on the known locations of all PHS species and habitats and develops management recommendations that summarize the best available science on the conservation needs of these species. PHS is currently the principal means by which WDFW provides important wildlife, fish and habitat information to local governments, state, tribal and federal agencies, private landowners and consultants for land use planning and conservation purposes. Many local governments incorporate PHS data directly into their Critical Areas Ordinances (CAO) required under Washington's Growth Management Act. Most of the data within PHS is derived from WDFW's Wildlife Resources Data System (WRDS). WRDS is the data engine currently supporting all WDFW wildlife data and includes survey data for Washington's species of concern, diversity and game species. (http://wdfw.wa.gov/hab/phspage.htm)

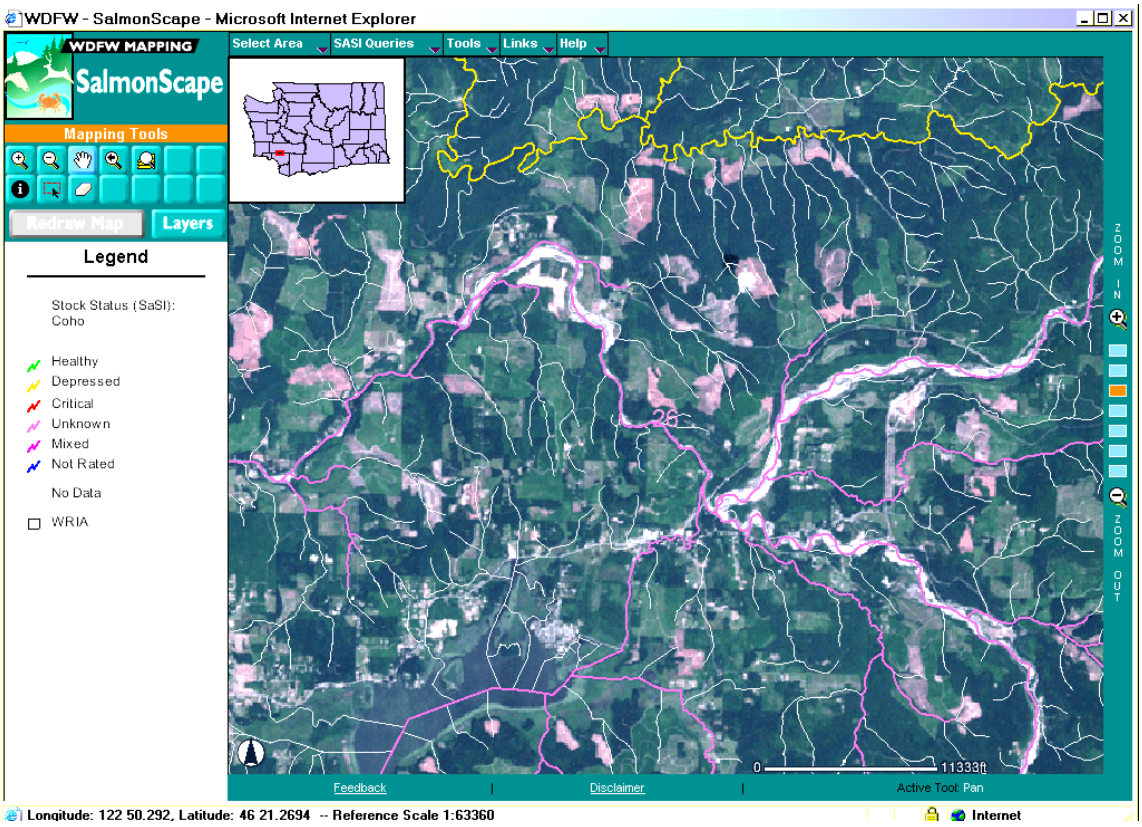
Salmon and Steelhead Habitat Inventory and Assessment Program (SSHIAP). SSHIAP supports a spatial data system that characterizes salmonid habitat conditions and distribution of salmonid stocks in Washington. WDFW and tribal co-managers initiated SSHIAP in 1995. All hydrology and data related to fish presence and use is derived from WDFW's Washington Rivers and Lakes Information System (WLRIS). WLRIS is a relational database GIS system that interlinks with the regional (Washington, Oregon, Idaho and Montana) data program StreamNet. (http://wdfw.wa.gov/hab/sshiap/)

Salmonid Stock Inventory Database (SaSI). WDFW developed SaSI in 1992 to identify changes in salmonid stock health and to prioritize recovery efforts. SaSI is a standardized, uniform approach to identifying and monitoring the status of Washington's salmonid fish stocks. The inventory is a compilation of data on all wild stocks and a scientific determination of each stock's status as healthy, depressed, critical, unknown or extinct. SaSI is a cooperative product of WDFW and tribal co-managers. (http://wdfw.wa.gov/fish/sassi/intro.htm).

Interactive Web Applications

As a public agency, WDFW strives to make data readily available to monitoring partners and the public through interactive, map-based web pages. WDFW's SalmonScape application supports interactive selection and display of spatial data sets such as salmonid distribution and use, migration barriers, preservation and restoration priorities, juvenile fish trap sites, SaSI stock status information, and stream habitat attributes housed within SSHIAP (Figure 38). These data can be displayed against many background layers, including administrative boundaries, roads, streams, major public land ownership, township/section lines, shaded relief imagery and orthophotos (http://wdfw.wa.gov/mapping/salmonscape/). WDFW plans to develop a separate application to house wildlife and fish data stored in PHS. Harvest data on recreationally harvested wildlife species is also made available through the GoHunt application (http://wdfw.wa.gov/mapping/gohunt/).

Figure 38. WDFW's SalmonScape application, depicting SaSI stock status for coho in southwestern Washington.



F. WDFW's Monitoring Partners

WDFW collaborates with several agencies at the state and federal level, tribes, and local and regional groups in prioritizing and conducting status and trends, research, and effectiveness monitoring for fish and wildlife species and their associated habitat. These include the U.S. Fish and Wildlife Service (USFWS), Bureau of Land Management (BLM), and the Washington Department of Natural Resources (WDNR) as well as Treaty Indian tribes, private forest landowners, utilities and land developers, conservation groups, and private citizen volunteers. WDFW works especially closely with WDNR's Washington Natural Heritage Program to design and implement monitoring programs for species that are a priority for both agencies.

Following the listing of several Pacific Northwest salmonids under the Endangered Species Act, more formalized partnerships have arisen relating to monitoring salmon recovery and watershed health. In 1998, the Washington legislature created the Governor's Salmon Recovery Office to coordinate and assist in the development of recovery plans for all listed salmon, steelhead and trout in Washington. Six locally driven regional groups formed to address salmon recovery with representation from local citizens and governments, tribes, state and federal agencies, and other interested parties. Each regional group has developed a draft recovery plan that includes a monitoring component; draft plans were submitted to the Governor's Salmon Recovery Office on June 30, 2005. (http://www.governor.wa.gov/gsro/regions/recovery.htm).

Several monitoring oversight groups have been convened in Washington to guide various monitoring components of wildlife and salmon recovery plans. In 1998, the Washington legislature created an Independent Science Panel to provide scientific review and oversight of salmon recovery planning efforts and specifically to provide technical advice on monitoring components of these plans. Additionally, the Independent Scientific Advisory Board was convened by the Northwest Power and Conservation Council and the National Marine Fisheries Service to provide scientific recommendations on wildlife and fish recovery programs falling under the Northwest Power Act. The Independent Scientific Review Panel reviews projects that are considered for funding under the Northwest Power and Conservation Council's Fish and Wildlife Program, including monitoring activities.

In 2001, the Washington legislature requested the development of the Washington Comprehensive Monitoring Strategy (http://www.iac.wa.gov/Documents/SRFB/Monitoring_Executive_Report_Final.pdf). This statewide monitoring strategy is focused on salmon recovery and watershed health, and has the objectives of standardizing monitoring protocols, integrating state agency efforts, and identifying gaps in monitoring programs. An action plan has been developed with full implementation scheduled for June 30, 2007.

Established by executive order in 2004, the Governor's Forum on Monitoring Salmon Recovery and Watershed Health was convened to provide a venue for ongoing cross-agency coordination on monitoring salmon recovery and watershed health, developing standardized monitoring indicators and protocols, and providing monitoring recommendations to Washington's legislature, Salmon Recovery Funding Board, the Governor's Salmon Recovery Office and appropriate state agencies.

In addition to engaging with the aforementioned groups, WDFW participates in regional monitoring forums such as the Pacific Northwest Aquatic Monitoring Partnership, Puget Sound Ambient Monitoring Program and the Collaborative System-wide Monitoring and Evaluation Project to identify consistent data sharing and sampling protocols for specific monitoring efforts. WDFW is incorporating EPA's Environmental Monitoring and Assessment Program protocols in new large-scale status and trend and research monitoring efforts involving interstate partners. A list of website links to the above referenced programs and agencies can be found at the end of this chapter.

G. Next Steps

Once the Washington CWCS is submitted and approved, WDFW will take a further look at its monitoring activities, priorities and protocols, including the PHS database, to determine what changes should be made to effectively monitor Species of Greatest Conservation Need and associated habitats identified in the CWCS. Based on this analysis, WDFW begin to will refine its monitoring activities for all Species of Greatest Conservation Need to try to match the level of effort and sophistication currently dedicated to salmon recovery. Much can be learned or adapted from systems that have been developed for salmon.

WDFW will also continue to work with other conservation partners and the Washington Biodiversity Council to further refine and develop the concept of a new Biodiversity Index, discussed below and in Chapter II, Biodiversity Conservation.

Refined Monitoring Activities

WDFW will continue to place a high priority on the recovery, management and status monitoring of all state listed endangered, threatened and sensitive species; however, WDFW will also begin to address the monitoring of other species included on the Species of Greatest Conservation Need that are not yet listed by Washington or the federal government. The intent of this process is to recover and conserve these species *before* they are state or federally listed. By law (WAC 232-12-297), WDFW must review the status of all listed species at least every five years. However, Washington's new SGCN list includes a number of species that are not listed as Washington Species of Concern, and WDFW will need to determine monitoring methods and frequency for these species. Current monitoring efforts of species on the SGCN list, including listed species, will be evaluated and broken down into the following categories:

- Species for which adequate monitoring is currently being done—those that currently receive sufficient monitoring attention to allow confident assessment of population status and trends. WDFW will seek to maintain the current level of monitoring for these species.

- Species that are currently receiving some level of monitoring but not adequate to determine with confidence any long-term changes in population size, relative abundance, distribution or habitat use. As resources permit, WDFW will expand status and trend monitoring for these species.

- Species on the SGCN list that are not currently being monitored by anyone on any predictable basis. WDFW will seek to initiate baseline surveys to assess population status and the need for additional monitoring.

- Species for which so little is known about life history and ecology that WDFW was not able to determine current status and trends to design a monitoring program. WDFW will seek to conduct basic research in ecological relationships for these species, followed by baseline surveys to assess population status and identify the need for trend or research monitoring.

Although many specific wildlife habitats are currently mapped and monitored as part of individual species management or recovery efforts, there is no coordinated statewide effort to monitor long-term habitat trends in Washington. Furthermore, while public land management agencies such as WDFW, WDNR, USFWS and USDA Forest Service monitor wildlife habitat on their own lands, there is currently no comprehensive effort designed for long-term assessment and monitoring of habitat on Washington's private lands, which comprise 60% of Washington's landscape, or on many public lands not specifically managed for fish and wildlife. In its 2003 report to the Governor and Legislature, the Washington Biodiversity Conservation Committee (now Biodiversity Council) recommended a number of actions that would improve and broaden the geographic scope of collaborative habitat monitoring. These actions include updating a statewide land use/land cover data layer. Periodic updates of the land use/land cover data would allow for trend analysis of habitat over time.

Biodiversity Index

In addition to reviewing monitoring programs for wildlife species and habitats, WDFW is proposing the adoption of a new statewide Biodiversity Index to track and measure long-term trends in Washington's biodiversity. Biodiversity conservation is one of the Six Guiding Principles of the Washington CWCS (see Chapter I, Introduction) and WDFW is committed to promoting the long-term conservation of Washington's biodiversity.

WDFW will work closely with the Washington Biodiversity Council and other partners, such as the Washington Natural Heritage Program, to establish a proposed public-private Biodiversity Monitoring Committee and to design and implement the new Biodiversity Index. This committee, if established, would be responsible for designing scientific protocols and implementing strategies that will guide the new biodiversity monitoring program. Measures of biodiversity will include species (plants and animals) and their habitats, and the protocols developed by the Committee will determine which species and habitats will be targeted for long-term biodiversity monitoring.

A key component of the proposed Biodiversity Monitoring Program would be a strong Citizen Science network to conduct data collection and reporting activities around the state. The cornerstone of this network will be the hundreds of K-12 schools in Washington, which would be used to monitor long-term biodiversity trends. Strict data collection protocols and quality control measures would be used to ensure that data are consistent and meet standards established by the Biodiversity Monitoring Committee. All biodiversity monitoring data would be centralized and reported back to the Washington State legislature as part of a formal performance agreement between WDFW, the Governor and the Legislature.

H. Adaptive Management and CWCS Review and Revision

Adaptive management is a systematic process for continually improving management strategies by monitoring the impacts of previous management actions. An adaptive management approach is particularly important in managing biological resources because of the inherent complexity and dynamism of natural systems and the scientific uncertainty associated with many natural processes. Adaptive management provisions have been successfully incorporated into regulatory mechanisms in Washington, including Washington's Forest Practices Rules, as well as long-term hydropower Habitat Conservation Plans on the Columbia River. Monitoring is essential for identifying needed changes in management strategies and thus is a critical component of adaptive management.

Washington will adopt an adaptive management approach to implement the CWCS. Through ongoing analysis of monitoring data and periodic review of the CWCS itself, WDFW will ensure that the appropriate changes will be made in the management or funding levels of monitored programs and projects to adapt to new conditions or circumstances. In reviewing the CWCS, WDFW will evaluate the SGCN and associated priority habitats, and the conservation problems, priorities and conservation actions identified at both statewide and ecoregional scales. In order to meet the monitoring requirements of the CWCS and determine the future monitoring requirements of SGCN, WDFW will consider the adequacy of all current monitoring programs, including ongoing and new collaborative efforts.

The first WDFW program review of the Washington CWCS and State Wildlife Grants program will take place in 2006. At that time, the ecoregional assessments will be completed for all nine ecoregions addressed in the CWCS, and WDFW will be able to fully integrate the information and recommendations into an update of the ecoregional chapters in the CWCS. Up to one year will have passed from the initial submittal of the CWCS to the National Advisory and Acceptance Team, allowing for a retrospective analysis. In 2006, WDFW will also develop budget recommendations for the 2007-2009 Washington biennial budget, which could be influenced by an initial review of the CWCS. Unlike the federal government, Washington agencies develop and implement their budgets on a biennial rather than annual basis; thus, the review and revision of the CWCS will be timed to coincide with the biennial budget cycle.

The next review and revision after 2006 will take place in 2008, when WDFW and other state agencies are again developing their agency budget recommendations for the 2009-2011 biennial budget. This review will not need to be as complete as the one done in 2006, nor as thorough as the first six-year program review, which will be conducted in 2012. Beginning in 2012, WDFW will do a full review of the CWCS and State Wildlife grants program in consultation with other conservation partners and affected stakeholders every six years, with a less thorough review and revision scheduled for every two years to coincide with Washington's biennial budget development cycle.

I. Conclusion

Monitoring and adaptive management are critical elements of Washington's CWCS. The status and trends, research, project effectiveness and implementation monitoring efforts described in this chapter provide the means for gauging the health of Washington wildlife and fish populations and for determining whether or not conservation projects and programs are meeting WDFW's goals. These monitoring activities also serve as the cornerstone of Washington's adaptive management approach to implementing agency conservation programs and the CWCS. Through systematic, ongoing review of conservation management strategies and monitoring programs, WDFW will ensure that Washington is effectively conserving Species of Greatest Conservation Need, associated habitats and biodiversity at both the statewide and ecoregional scales, and will ensure that the monitoring requirements of the State Wildlife Grants program are met.

Following is the list of web hotlinks to programs and agencies discussed above in Section F, WDFW's Monitoring Partners.

Collaborative System-wide Monitoring and Evaluation Project
http://www.cbfwa.org/committees/csmep/

EPA's Environmental Monitoring and Assessment Program
http://www.epa.gov/emap/

Governor's Forum on Monitoring Salmon Recovery and Watershed Health
http://www.iac.wa.gov/monitoring/default.htm

Governor's Salmon Recovery Office
http://www.governor.wa.gov/gsro/regions/recovery.htm

Independent Science Panel
http://www.governor.wa.gov/gsro/science/default.htm

Independent Scientific Advisory Board
http://www.nwcouncil.org/fw/isab/background.htm

Independent Scientific Review Panel
http://www.nwcouncil.org/fw/isrp/background.htm

Pacific Northwest Aquatic Monitoring Partnership
http://www.reo.gov/PNAMP/

Puget Sound Ambient Monitoring Program
http://www.psat.wa.gov/Programs/PSAMP.htm

Salmon Recovery Funding Board
http://www.iac.wa.gov/srfb/default.asp

Washington Comprehensive Monitoring Strategy
http://www.iac.wa.gov/Documents/SRFB/Monitoring/Executive_Report_final.pdf
http://www.iac.wa.gov/Documents/SRFB/Monitoring/Comprehensive_Strategy_Vol_2.pdf
http://www.iac.wa.gov/Documents/SRFB/Monitoring/Action_Plan.pdf
http://www.iac.wa.gov/Documents/SRFB/Monitoring/Environmental_Monitoring_Survey.pdf